

IMPACT OF AN EDUCATIONAL STRATEGY TO INCREASE KNOWLEDGE,  
ATTITUDES, AND CONSUMPTION PATTERNS OF FRUITS AND VEGETABLES  
AMONG HIGH SCHOOL STUDENTS IN A RURAL MIDWESTERN COMMUNITY

A THESIS

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## ABSTRACT

THESIS: Impact of an Educational Strategy to Increase Nutrition Knowledge, Attitudes, and Consumption Patterns of Fruits and Vegetables among High School Students in a Rural Midwestern Community

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The purpose of this quasi-experimental study was to determine the impact of five 50-minute experiential lessons developed by the researcher on high school students' knowledge about, attitude toward, and consumption of fruits and vegetables. Subjects in this study included a convenience sample of 41 high school students enrolled in Family and Consumer Sciences classes at Crothersville Junior/Senior High School in Crothersville, Indiana, in the spring semester of 2011. A pretest was given to students in the Adult Roles class (control;  $n=19$ ) and the Nutrition and Wellness class (treatment;  $n=22$ ), after which students in the treatment group received five lessons containing additional depth and laboratory experiences where students prepared and tasted various fruits and vegetables. At the conclusion of the lessons, and nine weeks after the unit, the posttest was given to the control and treatment groups. Results indicated the lessons significantly increased students' knowledge compared to the control group ( $7.8 \pm 1.5$  vs.  $4.6 \pm 2.4$ ,  $F=26.27$ ;  $p = 0.000$ ), and nine weeks after the curriculum test ( $6.9 \pm 2.1$  vs.  $5.3 \pm 2.9$ ;  $F=4.46$ ,  $p=0.041$ ), but had a modest impact on these high school students' attitudes toward and consumption of fruits and vegetables.

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## **CHAPTER 1**

### **INTRODUCTION**

Consuming the recommended number of servings of fruits and vegetables has important health benefits, including a reduced risk for heart disease and stroke, hypertension, adult onset diabetes, obesity, some types of cancer, diverticulitis, cataract formation and macular degeneration (Appel et al.,1997; He, Nowson Lucas, & MacGregor, 2007; He, Nowson & MacGregor, 2006; Hung, Joshipura & Jiang, 2004). Fruits and vegetables provide micronutrients, fiber, antioxidants, and phytochemicals that are needed in a healthy diet. Current dietary guidelines recommend that individuals who consume a 2000 calorie diet should consume four and one-half cups of fruits and vegetables daily, with higher or lower amounts recommended (e.g., 2 ½ to 6 ½ cups or 5 to 13 servings) based on the individual's caloric level (MyPyramid.gov, 2011).

Analysis of two-day, 24-hour recall data from the 2003-2004 National Health and Nutrition Examination Survey (NHANES) indicated fewer than one in ten Americans meet their calorie-specific MyPyramid fruit or vegetable recommendations (Kimmons, Gillespie, Seymour, Serdula & Blanck, 2009). NHANES and Youth Risk Behavior Surveillance Survey (YRBSS) data consistently indicate most population groups, including teenagers, are at nutrition risk due to their low consumption of fruits and vegetables (CDC, 2010a). The 2007 YRBSS indicated only 21.4 percent of students had

eaten the recommended five or more servings of fruits and vegetables per day over the seven days preceding the survey (DHHS-CDC, 2007). In 2009, only 22.3 percent of the 16,057 teenagers who completed the survey reported having eaten fruits and vegetables five or more times per day (e.g., 100% fruit juices, fruit, green salad, potatoes [excluding French fries, fried potatoes, or potato chips], carrots, or other vegetables) during the seven days before the survey (CDC, 2010b).

Adolescents establish patterns of behavior and make lifestyle choices that affect their future health during their transition from childhood to adulthood, often struggling with behaviors such as physical activity and nutrition, which will affect their risk of developing chronic diseases in adulthood (Hendricks, Murdaugh & Pender, 2006). As such, identifying effective ways to increase adolescents' fruit and vegetable consumption can serve as an important public health strategy for the reduction of risk for chronic disease. However, few studies in the literature have been identified that focus specifically on the development of effective strategies to increase fruit and vegetable consumption for adolescents. To address this issue, Mao et al. (2010) suggested intervention strategies for adolescents should aim at improving awareness of the health benefits of fruit and vegetable intake and promoting confidence in their ability to consume the recommended servings.

## **Problem**

Students in middle and high school are faced with a plethora of food choices that challenge their ability to consume a healthful diet (Ehrens & Weber, 2009). Although consuming adequate fruits and vegetables is associated with a reduced risk for chronic

disease, YRBSS data indicate only one in five high school students eat the recommended five or more servings of fruits and vegetables per day (DHHS-CDC, 2007). Creative, effective ways to encourage high school students to increase their consumption of fruits and vegetables are needed.

### **Purpose**

The purpose of this quasi-experimental study was to determine the impact of five 50-minute nutrition lessons and cooking demonstrations/labs developed by this researcher on high school students' knowledge, attitude, and food consumption behavior of fruits and vegetables.

### **Research Questions**

This study addressed the following research questions:

- 1) Will completion of a five-day experiential unit that emphasizes nutrition knowledge and preparation of fruits and vegetables be associated with an increased knowledge about fruits and vegetables:
  - a. Immediately upon completion of the unit?
  - b. Nine weeks after completion of the unit?
- 2) Will completion of a five-day experiential unit that emphasizes nutrition knowledge and preparation of fruits and vegetables be associated with a more positive attitude toward fruits and vegetables?

- 3) Will completion of a five-day experiential unit that emphasizes nutrition knowledge and preparation of fruits and vegetables be associated with an increased consumption of fruits and vegetables?

### **Rationale**

Few American adolescents consume the daily recommended amount of fruits or vegetables (DHHS-CDC, 2007). Increasing America's fruit and vegetable consumption is an important public health strategy for weight management and reduction of risk for chronic disease. Implementing a five-day, hands-on curriculum that emphasizes the health benefits, preparation methods, and taste-testing of a variety of fruits and vegetables in a high school Family and Consumer Sciences class might be an effective way to increase the fruit and vegetable consumption of adolescents.

### **Assumptions**

The researcher makes the following assumptions in the implementation of the study and in the interpretation of the data:

- 1) The students will be truthful in their answers;
- 2) The students will be present for all five days of the intervention;
- 3) The survey questions will be an adequate proxy to measure the nutrition knowledge, attitudes, and food consumption behaviors of adolescents;
- 4) Students in the control group have not previously taken the food and nutrition course;
- 5) The classroom teacher will implement the lesson plans exactly as described.

## Definitions

For the purpose of this study, the following definitions will be used:

1. Phytochemicals - also called phytonutrient. Any of various bioactive chemical compounds found in plants that act as antioxidants; these compounds are considered to be beneficial to human health (Dictionary.com, 2010).
2. Free radicals - molecules produced when your body breaks down food or by environmental exposures such as tobacco smoke or radiation. Free radicals can damage cells, and may play a role in heart disease, cancer and other diseases (Dictionary.com, 2010).
3. Antioxidant - substances that may protect your cells against the effects of free radicals. Antioxidant substances include beta-carotene, lutein, lycopene, selenium, vitamin A, vitamin C, and vitamin E. Antioxidants are found in many foods, including fruits and vegetables, nuts, grains, and some meats, poultry and fish (MedlinePlus, 2010).
4. YRBSS (Youth Risk Behavior Surveillance Survey) - a nationwide survey led and funded by the Centers for Disease Control and Prevention (CDC) that monitors students' health risks and behaviors in the following six categories: 1) weight and diet, 2) physical activity, 3) injury and violence, 4) tobacco use, 5) alcohol and other drug use, and 6) sexual behaviors. The YRBSS is conducted every two years. Data from individual students and schools are confidential. The CDC analyzes the data and provides results to each participating state (IN.gov, 2010).
5. NHANES (National Healthy and Nutrition Examination Survey) - NHANES is part of the federal government's ongoing nutrition surveillance system.

NHANES is designed to assess the health and nutritional status of a cross-section of adults and children in the United States through interviews and physical examinations (CDC, 2010).

6. High School - a school, especially in the United States, usually including grades 9-12 or 10-12 (Dictionary.com, 2010).
7. NASAFACS (National Association of State Administrators of Family and Consumer Sciences Education) - The national standards for Family and Consumer Sciences (FACS) that drive the FACS curriculum were developed by the NASAFACS. The curriculum standards organize the subject matter and processes of Family and Consumer Sciences Education, provide a strong and clear conceptualization of the field, and establish a common direction for program development and revision at the national, state, and local levels (NASAFACS, 2008).

## **Summary**

An adequate consumption of fruits and vegetables is critical to promoting good health. Fruits and vegetables contain essential vitamins, minerals, and fiber that may help protect individuals from chronic diseases (USDA/DHHS, Dietary Guidelines for Americans, 2010). The purpose of this study was to examine the impact of a series of five nutrition lessons and cooking demonstrations/labs developed by this researcher on high school students' knowledge, attitude, and food consumption behavior of fruits and vegetables.



## **CHAPTER 2**

### **REVIEW OF LITERATURE**

The purpose of this quasi-experimental study was to determine the impact of five 50-minute nutrition lessons and cooking demonstrations/labs developed by this researcher on high school students' knowledge, attitude, and food consumption behavior of fruits and vegetables. This chapter will present a review of the literature that describes the role of the National Association of State Administrators for Family and Consumer Sciences Education in the development of national standards related to nutrition and wellness, current fruit and vegetable consumption of high school students, the impact of fruits and vegetables on health, methods to assess fruit and vegetable intake, and programs that have been developed in an effort to increase the fruit and vegetable intake among children and high school students, both in the school and the community.

#### **National and State Standards in Family and Consumer Sciences**

The National Association of State Administrators for Family and Consumer Sciences Education (NASAFACS) was the first organization that developed national standards for Family and Consumer Sciences. The NASAFACS provides the framework

for national, state, and local programs that prepare students for family life, work life, and careers in Family and Consumer Sciences by empowering individuals and families across the life span to manage the challenges of living and working in a diverse global society (NASAFACS, 2008).

The national standards used in this study were selected from the nutrition and wellness area of study. The state of Indiana has adopted these national standards to be used in Family and Consumer Sciences classes (Department of Education, 2010). The national standards include students' ability to:

- 14.1 Analyze factors that influence nutrition and wellness practices across the life span;
- 14.2 Evaluate the nutritional needs of individuals and families in relation to health and wellness across the life span;
- 14.3 Demonstrate ability to acquire, handle, and use foods to meet nutrition and wellness needs of individuals and families across the life span;
- 14.4 Evaluate factors that affect food safety from production through consumption; and
- 14.5 Evaluate the influence of science and technology on food composition, safety, and other issues.

### **Fruit and Vegetable Consumption of High School Students**

Dietary Guidelines for Americans currently recommend the consumption of a minimum of five servings of fruits and vegetables per day (USDA/DHHS, 2010; MyPyramid.gov, 2011), yet studies show that most populations, including adolescents,

consistently do not reach this goal (Casagrande, Wang, Anderson, & Gary, 2007; Kimmons et al., 2009; CDC, 2010b).

Kimmons et al. (2009) analyzed data from two, 24-hour dietary recalls from the 2003-2004 National Health and Nutrition Examination Survey (NHANES) to determine the median fruit and vegetable consumption from all dietary sources among adolescent and adult consumers, the percentage of adolescents and adults meeting individual recommended intake levels based on caloric requirements, consumption levels among various demographic groups, intake levels from subtypes of fruits and vegetables, and primary contributors to fruit and vegetable intake. The study included dietary contributions of fruits and vegetables from all dietary sources. Results indicated fewer than one in ten Americans meet their specific MyPyramid fruit or vegetable recommendations. The largest single contributor to overall fruit intake for both adults and adolescents was “orange juice.” “Whole fruits” were the primary contributor to total fruit intake for adults, while “fruit juices” were the primary contributor to total fruit intake for adolescents. “Potatoes” dominated vegetable consumption, particularly among adolescents. The consumption of fried potatoes increased the median vegetable intake of adolescents from 0.72 cups to 1.21 cups per day. Dark green and orange vegetables and legumes accounted for a small portion of vegetable intake, with few people meeting the recommendations. Kimmons et al. (2009) noted that few American adolescents or adults reported consuming the recommended amounts of fruits or vegetables. These authors concluded that increasing the consumption of fruits and vegetables will require multifaceted approaches that augment educational campaigns with policy and

environmental strategies aimed at the entire food system, from farm to plate, including schools, worksites, and retail establishments.

Casagrande et al. (2007) analyzed 24-hour dietary recall data from NHANES III, 1988-1994 and NHANES 1999-2002 to identify trends in fruit and vegetable consumption. In 1988-1994, an estimated 27 percent of adults met the USDA guideline for fruit and 35 percent met the guideline for vegetables. In 1999-2002, 28 percent and 32 percent of adults met fruit and vegetable guidelines, respectively, indicating a stable intake of fruit but a decrease in vegetable consumption over time. Only 11 percent of adults met USDA guidelines for both fruits and vegetables in 1988-1994 and 1999-2002. In both data sets, non-Hispanic blacks were less likely to meet USDA guidelines than non-Hispanic whites. Individuals with higher incomes and more education were significantly more likely to meet the guidelines in both data sets than were those with a low income and less education. Despite the initiation of a national fruit and vegetable campaign in 1991 (e.g., “5-A-Day”), this national data indicate that Americans’ fruit and vegetable consumption did not increase from 1988-1994 to 1999-2002 and only a small proportion of individuals met the related dietary recommendations. The authors concluded greater public health efforts and approaches are needed to promote healthy eating in the United States.

The national Youth Risk Behavior Surveillance Survey (YRBSS) monitors six categories of priority health-risk behaviors among youth and young adults, including unhealthy diet behaviors. YRBSS provides representative data for students in grades 9 through 12 in both public and private schools throughout the United States. Of the students taking the survey in 2007, only 21.4 percent reported they had eaten the

recommended five or more servings of fruits and vegetables per day over the seven days preceding the survey. In 2009, 22.3 percent of the 16,057 teenagers who completed the survey reported having eaten fruits and vegetables five or more times per day (e.g., 100% fruit juices, fruit, green salad, potatoes [excluding French fries, fried potatoes, or potato chips], carrots, or other vegetables) during the seven days before the survey (CDC, 2010b).

Kubik, Lytle, Hannan, Perry & Story (2003) examined the association between the dietary behaviors of 598 seventh grade students in 165 schools based on the availability of school vending machines, a la carte programs, and whether or not fried potatoes were served at school lunch. Dietary behaviors were measured using a 24-hour dietary recall. Results indicated a la carte availability (e.g., candy, chips, and cookies) was inversely associated with fruit and the combined fruit and vegetable consumption. The availability of snack vending machines was negatively correlated with fruit consumption. Serving fried potatoes in the school lunch, however, was positively associated with vegetable and the combined fruit and vegetable intake. The authors concluded school-based programs that aim to promote healthy eating among youths should target school-level environmental factors.

Krebs-Smith, Cook, Subar, Cleveland, Friday & Kahle (1996) conducted a study to identify major ways fruits and vegetables are consumed by children to provide estimates of their intakes compared with recommendations, and to estimate the percentage of children meeting those recommendations. The authors examined three days of dietary data from respondents in the 1989-1991 Continuing Survey of Food Intakes by Individuals (CSFII). All foods reported in the survey were disaggregated into

their component ingredients; all fruit and vegetable ingredients were assigned specific weights to correspond with a serving as defined by current dietary guidance materials; and the number of servings of each fruit and vegetable was tallied. A total of 3,148 children and adolescents aged 2 to 18 years participated in the study. Results indicated that nearly one-quarter of all vegetables consumed by children and adolescents were French fries. Their intakes of all fruits and of dark green and/or deep yellow vegetables were very low compared with recommendations. Only one in five children consumed five or more serving of fruits and vegetables per day. The authors concluded that pediatricians should encourage children to increase their consumption of fruits and vegetables, especially dark green and deep yellow vegetables.

Rasmussen, Krølner, Klepp, Lytle, Brug, Bere & Due (2006) conducted a review of the literature to identify potential determinants of fruit and vegetable intake in children and adolescents. Papers from Medline and PsycINFO were identified by using all combinations of the search terms: “fruit(s) or vegetable(s)” and “children or adolescents.” Quantitative research examining determinants of fruit and/or vegetable intake among children and adolescents aged 6-18 years were included. The selection and review process was conducted according to a four-step protocol resulting in information on country, population, design, methodology, theoretical basis, instrument used for measuring intake, statistical analysis, independent variables, and effect sizes. Ninety-eight papers were identified. Convincing evidence is lacking for many presumed determinants, mostly due to the paucity of studies. The evidence-based determinants most strongly associated with an increased intake of fruits and vegetables include age, gender, socio-economic position, preferences, parental intake, and home

availability/accessibility. Results indicated girls and younger children tend to have a higher or more frequent intake than boys and older children. Socio-economic position, preferences, parental intake, and home availability/accessibility were all consistently positively associated with fruit and vegetable intake. The authors suggested there is a need for internationally comparative, longitudinal, theory-based and multi-level studies that examine both personal and environmental factors associated with fruit and vegetable consumption.

### **Importance of Fruits and Vegetables to Health**

The Dietary Guidelines for Americans 2010 (USDA/DHHS, 2010) and the Food Guide Pyramid (MyPyramid.gov, 2010) suggest individuals consume a minimum of five servings of fruits and vegetables per day as part of a healthy eating pattern while staying within their calorie needs. Americans are encouraged to eat a variety of vegetables, especially dark-green, red and orange vegetables, beans and peas.

Fruits and vegetables provide many vitamins and minerals, phytochemicals, antioxidants, and fiber (USDA/DHHS, 2010; MyPyramid.gov, 2011). Calcium, found naturally in spinach and collard greens and in fortified juices, is essential for healthy bones and teeth and for the normal functioning of muscles, nerves and some glands. Diets rich in folic acid, found in dark green and leafy vegetables, have been shown to reduce the risk of having a child with a brain or spinal cord defect. Magnesium, found in spinach, butternut squash, chickpeas, and pinto beans, is necessary for healthy bones and is involved with more than 300 enzymes in the body. Inadequate levels may result in muscle cramps and high blood pressure. Vitamin A keeps eyes and skin healthy and

helps protect against infections. Diets rich in potassium help maintain a healthy blood pressure. Vitamin C helps heal cuts and wounds and keeps teeth and gums healthy (MyPyramid.gov, 2011).

Fruits and vegetables should be a part of a well-balanced and healthy eating plan. Diets rich in fruits and vegetables may reduce the risk of some types of cancer and other chronic diseases, so adding them to each meal is important. Substituting vegetables for two ounces of cheese or two ounces of meat on your sandwich is a way to incorporate more vegetables (MyPyramid.gov, 2011).

He, Nowson, Lucas & MacGregor (2007) assessed the relation between fruit and vegetable intake and incidence of coronary heart disease (CHD) by carrying out a meta-analysis of cohort studies. Studies were included if they reported relative risks and corresponding 95% confidence intervals for coronary heart disease with respect to frequency of fruit and vegetable intake. Twelve studies, consisting of 13 independent cohorts, met the inclusion criteria. In total, data from 278,459 individuals with a median follow-up of 11 years were analyzed. Compared with individuals who had less than three servings/day of fruit and vegetables, the pooled RR of CHD for those who ate between three and five servings/day was 0.93 (95% CI: 0.86-1.00,  $P=0.06$ ) and 0.83 (0.77-0.89,  $P<0.0001$ ) for those who ate five or more servings per day. Subgroup analyses showed that both fruits and vegetables had a significant protective effect on coronary heart disease. This meta-analysis of prospective cohort studies demonstrated that increased consumption of fruit and vegetables from less than three to more than five servings/day is related to a 17 percent reduction in coronary heart disease risk, whereas an intake of between three to five servings/day is associated with a smaller and borderline significant



reduction in coronary heart disease risk. The authors' results provide strong support for the recommendations to consume more than 5 servings/day of fruits and vegetables.

There is compelling evidence that a diet rich in fruits and vegetables can lower the risk of heart disease and stroke. The largest and longest study to date, done as part of the Harvard-based Nurses' Health Study and Health Professionals Follow-up Study, included almost 110,000 men and women whose health and dietary habits were followed for 14 years (Joshipura et al., 2001). Results indicated the higher the average daily intake of fruits and vegetables, the lower the chance of developing cardiovascular disease. Compared with those in the lowest category of fruit and vegetable intake (less than 1.5 servings a day), those who averaged 8 or more servings a day were 30 percent less likely to have had a heart attack or stroke. Although all fruits and vegetables likely contribute to this health benefit, green leafy vegetables, cruciferous vegetables, and citrus fruits appear to make the most important contributions (Joshipura, et al., 2001).

Chainani-Wu, Epstein & Touger-Decker (2010) examined the relationship between consumption of a diet high in fruits, vegetables and plant-based foods and the reduction in the incidence of oral cancer. These authors found that dietary supplements, including vitamins and minerals, have not been shown to be effective substitutes for a diet high in fruits and vegetables. The authors suggest that, in addition to discussing tobacco and alcohol use with patients, clinicians should provide dietary advice (e.g., to increase consumption of a variety of fruits and vegetables) as part of their routine patient education practice to prevent oral cancer.

Fung, Hu, Wu, Chiuve, Fuchs & Giovannucci (2010) assessed the association between the Alternate Mediterranean Diet and the Dietary Approaches to Stop

Hypertension (DASH) diet scores and risk of colorectal cancer in middle-aged men and women. A total of 87,256 women and 45,490 men without a history of cancer were followed 26 or fewer years. The Alternate Mediterranean Diet and DASH scores were calculated for each participant by using dietary information that was assessed seven or fewer times during follow-up. The authors concluded that adherence to the DASH diet (which involves higher intakes of whole grains, fruit, and vegetables; moderated amounts of low-fat dairy; and lower amounts of red or processed meats, desserts, and sweetened beverages) was associated with a lower risk of colorectal cancer.

Appel et al. (1997) assessed the effects of dietary patterns on blood pressure. The authors enrolled 459 adults with systolic blood pressures of less than 160 mm Hg and diastolic blood pressures of 80-95 mm Hg. For three weeks, the subjects were fed a control diet that was low in fruits, vegetables, and dairy products, with a fat content typical of the average diet in the United States. Subjects were then randomly assigned to the control diet; a diet rich in fruits and vegetables; or a “combination” diet rich in fruits, vegetables, and low fat-dairy products and with reduced saturated and total fat. Sodium intake and body weight were maintained at constant levels. Subjects consumed their assigned diet for eight weeks. Results indicated the “combination diet” reduced systolic and diastolic blood pressure by 5.5 and 3.0 mm Hg more, respectively, than the control diet, while the “fruits-and-vegetables diet” reduced systolic and diastolic blood pressure by 2.8 and 1.1 mm Hg more, respectively, than the control diet. Among the 133 subjects with hypertension, the combination diet reduced systolic and diastolic blood pressure by 11.4 and 5.5 mm Hg more, respectively, than the control diet; among the 326 subjects without hypertension, the corresponding reductions were 3.5 mm Hg and 2.1 mm Hg.

The authors concluded that a diet rich in fruits, vegetables, and low-fat dairy foods and with reduced saturated and total fat can substantially lower blood pressure.

### **Methods to Assess Fruit and Vegetable Intake**

Several methods have been used to quantify an individual's usual fruit and vegetable intake, including the food frequency questionnaire, 24-hour dietary recalls, food records, and surveys. The pros and cons of each method will be described.

Noia and Contento (2009) tested the validity of the 5 A Day for Better Health Program food frequency questionnaire (FFQ) for estimating fruit and vegetable consumption using a sample of 156 African-American adolescents aged 10 to 14 years. To determine validity, the correlation between 5 A Day FFQ fruit, juice, and vegetable intake and 3-day intake measured by direct observation was assessed. Correlations were calculated separately by food type (e.g., fruits, juices, and vegetables), gender and age to determine whether the accuracy of youths' recordings differed based on these factors. The ability of the 5 A Day FFQ to correctly classify youths according to intake level was also examined. Results obtained from the 5 A Day FFQ intake were significantly correlated with observed intake. Correlations were weaker by food type and did not differ based on youths' gender or age. The mean 5 A Day FFQ intake was considerably higher than the mean observed intake as a result of the overestimation of vegetable intake. Sensitivity, specificity, and positive and negative values of the 5 A Day FFQ were 67.1 percent, 68.6 percent, 63.5 percent, and 71.9 percent, respectively. These findings suggest that the 5 A Day FFQ may be more useful as a screening tool for

identifying African-American adolescents most in need of intervention than for estimating youths' actual mean intake in dietary intervention programs.

Rockett & Colditz (1997) reviewed nutritional assessment methods used in young people to assess their fruit and vegetable intake. The authors provided an overview of the methods used in these investigations, compared the available dietary assessment tools (the dietary record, 24-hour dietary recall, and food frequency questionnaire), described the development of a new food-frequency questionnaire (the Youth-Adolescent Questionnaire), and reviewed new approaches to assessing fruit and vegetable intake. The data emerging from reproducibility studies suggest that food-frequency questionnaires provide enough accuracy in studies of adolescents to permit individual diets to be related to subsequent health outcomes.

### **Programs to Increase Fruit and Vegetable Intake in Children**

Garden-based nutrition education programs may offer a strategy for increasing fruit and vegetable intake in children. Heim, Stang & Ireland (2009) designed a 12-week pilot intervention to promote fruit and vegetable intake among 4<sup>th</sup> through 6<sup>th</sup> grade children attending a YMCA summer camp. Children participated in garden-based activities twice per week. Weekly education activities include fruit and vegetable snacks, and family newsletters sent home to parents. The pilot intervention was evaluated using a pre and post survey to determine participant satisfaction and the short-term impacts of the program. The process evaluation focused on program satisfaction, whereas the short-term impact evaluation assessed fruit and vegetable exposure, preference, self-efficacy, asking behavior, and availability of fruits and vegetables in the home. Data from the

impact evaluation were compared from baseline to follow-up. Children reported high levels of enjoyment in the intervention activities. Most children (97.8%) reported they enjoyed taste-testing fruits and vegetables, preparing fruit and vegetable snacks (93.4%), working in their garden (95.6%), and learning about fruit and vegetables (91.3%).

Impact data suggest that the garden intervention led to an increase in the number of fruits and vegetables eaten, vegetable preferences, and fruit and vegetable asking behavior at home. Results indicate garden-based nutrition education programs can increase fruit and vegetable exposure and improve predictors of fruit and vegetable intake through experiential learning activities. Participants in the “seed to table” experience of eating may help promote healthful eating behaviors among youth. The authors recommended that food and nutrition professionals should consider garden-based nutrition education programs that connect children with healthful foods through fun, hands-on activities.

Schools are the most frequent target for intervention programs aimed at preventing child obesity; however, the overall effectiveness of these programs has been limited. It has therefore been recommended that interventions target multiple ecological levels (community, family, school and individual) to have greater success in changing risk behaviors for obesity. Gentile et al. (2009) examined the immediate and short-term, sustained effects of the Switch program, which targeted three behaviors (decreasing children’s screen time, increasing fruit and vegetable consumption, and increasing physical activity) at three ecological levels (the family, school, and community).

Participants included 1,323 children and their parents from ten schools in two states.

Schools were matched and randomly assigned to treatment and control. Measures of the key behaviors and body mass index were collected at baseline, immediately post-

intervention, and six months post-intervention. The effect sizes of the differences between treatment and control groups ranged between small (Cohen's  $d = 0.15$  for body mass index at six months post-intervention) to large (1.38; parent report of screen time at six months post-intervention), controlling for baseline levels. There was a significant difference in parent-reported screen time at post-intervention in the experimental group, and this effect was maintained at six months post-intervention. The experimental group also showed a significant increase in parent-reported fruit and vegetable consumption, while child reported fruit and vegetable consumption was marginally significant. At the six month follow-up, parent-reported screen time was significantly lower, and parent and child-reported fruit and vegetable consumption was significantly increased. There were no significant effects on pedometer measures of physical activity or body mass index in the experimental group. The intervention effects were moderated by child sex, family involvement, and child body mass index. The perception of change among the experimental group was generally positive, with 23 percent to 62 percent indicating positive changes in behavior. The results indicated that the Switch program yielded small-to-modest treatment effects for promoting children's fruit and vegetable consumption and minimizing screen time. The authors suggested the Switch program offers promise for use in youth obesity prevention.

Fitzgerald & Spaccarotella (2009) reviewed common barriers to healthful eating and physical activity by using an ecological framework. The authors categorized the barriers into the four ecological model levels (e.g., intrapersonal, interpersonal, community/institution, and macro/public policy), highlighting the need for multifaceted approaches to overcome these barriers. The authors reported programs that increase

awareness, knowledge, skills, motivation, and confidence would be best suited for overcoming intrapersonal barriers, while programs that emphasize the replacement of screen time with more active pursuits and helping parents to establish strategies to control the amount of screen time and the influences of advertisements would help overcome interpersonal barriers. Community partnerships and policy level interventions, such as parks, zoning, and development regulations, would be suitable to overcome community/institution level barriers. The authors observed it is important for extension educators to be aware of the food-related advertisement trends and regulations at the state and national level in order to be able to help families more effectively overcome macro/public level barriers. The authors concluded that the abundance of barriers operating at various levels underscores the need for multifactorial approaches to promote healthy lifestyle behaviors. Ecological models can be useful tools for extension professionals to develop such interventions. Extension professionals are in a perfect position, as subject experts, community members, and leaders, to apply similar multifaceted approaches extending from individual solutions to public policy efforts in promoting healthier lifestyles.

Perry et al. (1998) conducted a randomized school-based trial to increase fruit and vegetable consumption among children using a multi-component approach. The intervention, conducted in 20 elementary schools in St. Paul, MN, targeted a multiethnic group of children who were enrolled in fourth grade in the spring of 1995 and in fifth grade in the fall of 1995. The multi-faceted intervention consisted of behavioral curricula in the classroom, parental involvement, school food service changes, and industry support and involvement. Lunchroom observations and 24-hour food recalls were used to

measure food consumption. Parent telephone surveys and a health behavior questionnaire measured psychosocial factors. Results indicated the intervention was associated with increased lunchtime fruit consumption and combined fruit and vegetable consumption, lunchtime vegetable consumption among girls, and daily fruit consumption, as well as the proportion of total daily calories attributable to fruits and vegetables. The authors concluded that this multi-component school-based program increased fruit and vegetable consumption among children. Greater involvement of parents and more attention to increasing vegetable consumption, especially among boys, remains a challenge in future intervention research.

### **Nutrition Education in School Curriculums**

Many factors have been identified that influence adolescent eating behavior, including peer influences, nutrition knowledge and beliefs, mass media, and parental dietary habits. Pirouznia (2001) examined the correlation of nutrition knowledge and eating behavior in a sample of 532 students between the ages of 11 and 13 years who were in grades six, seven or eight from Shawnee Middle School in Lima, Ohio. The students were asked to complete the CANKAP (Comprehensive Assessment of Nutrition Knowledge, Attitudes, and Practices) questionnaire which measured their nutrition knowledge and eating behavior. Two versions of the CANKAP were created, one for sixth graders and one for seventh/eighth graders. The sixth grade test contained 30 questions of which 20 were nutrition knowledge questions. The test for the seventh and eighth grade students contained 35 questions, of which 30 were nutrition knowledge



questions. Each knowledge scale was determined to have a Cronbach's alpha reliability coefficient of 0.70 or greater.

There was no difference in nutrition knowledge between sixth-grade boys (13.40) and girls (13.96) ( $F = 1.03$ ,  $P = 0.3$ ). However, ANOVA indicated the mean nutrition knowledge scores of seventh and eighth-grade girls (12.35) were significantly higher than boys (10.86) ( $F = 17.88$ ,  $P < .001$ ). There was no correlation between nutrition knowledge and food choices for sixth-grade male or female students or for boys in the seventh and eighth grades. There was, however, a significant correlation ( $P < .006$ ) between nutrition knowledge and food choices for girls in the seventh and eighth grades. Pirouznia (2001) concluded that female adolescents are more selective in their food choices than males. As a result of the insignificant relationship between nutrition knowledge and eating behavior of sixth-grade students and males in seventh and eighth grades, the author suggested corrective measures, such as implementing nutrition education programs in elementary schools, as eating habits are more likely to be shaped in younger ages, and organizing programs and activities in science and health classes to motivate students to learn about nutrition, are indicated.

Gower, Moyer-Mileur, Wilkinson, Slater & Jordan (2010) tested the validity and reliability of a computer nutrition knowledge survey that they used with elementary school students to evaluate the impact of the "Fit Kids 'r' Healthy Kids" nutrition intervention. During survey development, twelve health educators, elementary school teachers and registered dietitians assessed the survey for content validity. The target population consisted of first through fourth grade students from Salt Lake City, UT, metropolitan area schools. Participants were divided into reliability, intervention, and

control groups. The reliability group took the survey twice (2 weeks apart); the intervention and control groups also took the survey twice, but at pre- and post-intervention (4 weeks later). Only students from the intervention group participated in four weekly nutrition classes. Reliability was assessed by Pearson's correlation coefficient. Results demonstrated appropriate content validity, as indicated by expert peer ratings. Test-retest reliability correlations were found to be significant for the overall survey and for all subscales: food groups, healthful foods, and food functions. Nutrition knowledge was assessed upon program completion using a paired samples *t* test. Students from the intervention group demonstrated improvement in nutrition knowledge, while scores for the control group remained unchanged. The difference in total scores from pre- to post-intervention between the two groups was significant. These results suggest that the computerized nutrition survey demonstrated content validity and test-retest reliability for first- through fourth-grade elementary school children. Also, the study results imply that the Fit Kids 'r' Healthy Kids intervention promoted gains in nutrition knowledge. Overall, the computer survey shows promise as an appealing medium for assessing nutrition knowledge in children.

In response to the increased incidence of child overweight, a school-based program, *It's All About Kids*, was designed by the Tulsa Health Department, Tulsa Public Schools, and community partners to improve food choices and increase physical activity of students in first through fifth grade. The nutrition component consisted of six weekly 30-minute experiential, age-appropriate classroom lessons, including healthful-eating food games, taste-testing foods, whole-grain bread baking, information on portion sizes, and food demonstrations. Documenting and evaluating school-based intervention

programs is critical for setting evidence-based health policy, justifying funding, and achieving broader implementation of successful interventions. To evaluate the effectiveness of the *It's All About Kids* nutrition component in fourth-grade children, DeVault, Kennedy, Hermann, Mwavita, Rask & Jaworsky (2009) conducted a controlled trial from 20 fourth-grade classes in five intervention and five comparison Title I public schools. Evaluation included 140 fourth-grade students, including 69 in the comparison group and 71 in the intervention group. Outcomes were measured by pre-, post-, and follow-up tests using a modified version of the Pathways Knowledge, Attitudes, and Behaviors questionnaire and the Child and Adolescent Trial of Cardiovascular Health (CATCH) Food Checklist. Data were analyzed using repeated measures analysis of variance over time controlling for sex, paired samples *t* tests, and independent samples *t* test. Intervention students had significant improvements in knowledge of which food had more fat. Intervention students' behavioral intent scale scores for food choice intentions improved significantly. Self-reported consumption of saturated fat and sodium improved considerably in both intervention and comparison students. Devault et al. (2009) concluded that results support a broader program implementation. More reinforcement over time may be needed to sustain the level of improvement.

Berg, Jonsson, Conner & Lissner (2002) investigated dietary knowledge and beliefs of school children in relationship to breakfast choices, with specific attention to fat and fiber content. Food choice and perceptions were studied by interviews using the "stacking box methodology." Youth, aged 11-15 years, were instructed to select food items among photographs of breakfast foods. In addition to choosing their own typical breakfasts, they were asked to exchange food in hypothetical breakfasts to create meals

with less fat and more fiber. The interview also dealt with recent changes in breakfast habits, and perception of healthy breakfasts, dietary fat, and foods rich in fiber. Data were analyzed by logistic regression. Results indicated that knowledge concerning sources and health attributes of dietary fiber was associated with usual consumption of bread and breakfast cereal rich in fiber. In a similar way, a positive attitude toward limited fat intake predicted consumption of reduced-fat milk products. However, no association was observed between food choices and knowledge of a food-packaging symbol indicating low-fat and fiber-enriched foods. The authors concluded that lack of awareness of, and knowledge about, healthy eating may be important barriers to the development of health promoting food habits by schoolchildren.

### **Programs to Increase Fruits and Vegetables in High School Student**

As rates of childhood obesity rise, the nutritional content of lunches eaten at schools is being heavily scrutinized. Hastert & Babey (2009) examined the association between dietary behaviors and the number of days that adolescents bring lunch to school. These authors analyzed cross-sectional data for 2,774 adolescents who responded to the 2005 California Health Interview Survey and reported dietary behaviors for a weekday. Results indicated that adolescents who typically brought their lunch from home 5 days per week ate fast food on fewer occasions; consumed fewer servings of soda, fried potatoes, and high-sugar foods; and ate more fruits and vegetables compared with adolescents who never brought their lunch to school. Linear regression, controlling for demographics, body mass index, desire to change weight, parent education, and adult presence after school, indicated students who typically brought their lunch to school five

days per week ate fast food 0.35 fewer times and consumed 0.35 fewer servings of soda, 0.10 fewer servings of fried potatoes, 0.25 fewer servings of high-sugar foods, and 0.95 more servings of fruits and vegetables per day compared with students who never brought their lunch to school. These findings suggest that adolescents who bring lunch to school from home have more positive dietary behaviors than do adolescents who get their lunches from other sources. The authors concluded that improving the nutritional quality of foods offered from other sources, such as the National School Lunch Program and competitive foods, could help improve adolescent dietary behaviors.

Jan, Bellman, Barone, Jessen & Arnold (2009) assessed the preliminary results of the effectiveness of *Shape It Up*, a school-based obesity prevention program developed and implemented by the Ernest Mario School of Pharmacy at Rutgers University in conjunction with Horizon Blue Cross Blue Shield of New Jersey. Program activities and materials included an interactive workshop, an activity book and family guide, posters, a website, and educational field days. The *Shape It Up* program not only delivered a positive message about eating healthful food, but it also modeled fruit and vegetable consumption during the interactive workshops and distributed fruits and vegetables as prizes. During the 2004-2005 and 2005-2006 school years, *Shape It Up* was delivered to 89,736 children at 257 New Jersey elementary schools. Pre-intervention and post-intervention surveys were administered to a convenience sample of 6,421 students at 49 participating schools. Attitudes were measured using a 6-point Likert-type graphic face scale and analyzed for statistical significance of pre-intervention to post-intervention change using paired t-tests. After exposure to the *Shape It Up* program, children reported higher levels of knowledge and positive attitudes about healthy eating and exercise

compared with the baseline survey results. In a question to gauge satisfaction with the program, 54.9 percent of children surveyed gave the program the highest possible rating, and overall 91.7 percent selected one of the three response categories toward the positive end of the six-point scale. *Shape It Up* appears to have had a positive impact on children's knowledge and attitudes toward exercise and healthy eating. Additional research employing a comparison group is needed to assess the program's impact.

Schools have the opportunity, through the National School Lunch Program and Local School Wellness Policies, to have a significant impact on healthy eating behaviors. An understanding of children's and adolescent's food preferences in relation to gender and age will facilitate the successful creation of both healthy and financially viable school menus. Caine-Bish & Scheule (2009) identified food preferences with respect to gender of school-age children and adolescents in an Ohio school district. A survey was administered to 1,818 third to twelfth grade students. Students filled out an anonymous questionnaire about their preferences for 80 different foods using a five-point rating scale. The students' data were grouped according to school level attended: elementary, middle, and high school. An exploratory factor analysis was conducted to identify "entrée" and "side dish" factors. Cronbach's alpha was used to measure each factor's internal reliability. Differences in mean scores by gender and grade for each of the entrée and side dish factors were identified using analysis of variance. Results showed that boys preferred the meat, fish, and poultry foods over girls, whereas girls preferred fruits and vegetables over boys. Furthermore, gender differences in preferences were demonstrated with respect to school level. The authors concluded that food preferences differed between genders and these gender differences varied among elementary, middle, and

high school students. Gender differences should be considered when providing food choices to boys and girls at all ages.

Communication technology can help stimulate youth to become involved in health promotion. DiSogra & Glanz (2000) reported on an innovative, Internet based nutrition program that encouraged children to be advocates for policies that promote eating more fruits and vegetables, the 5 A Day Virtual Classroom. Through this program, students from across the United States discussed the recommendation of 5 A Day, at the same time, in a classroom without walls. In September 1997, children were asked, "If you were President Clinton, how would you get kids across the country to eat 5 A Day?" Based on content analysis of responses, they suggested strategies that policymakers could use to encourage children to consume more fruits and vegetables. Approximately 2,600 students participated; 635 entries and 910 suggestions were received. The suggestion categories cited most often were mass media, economic issues, and social influence. The most frequently mentioned specific ideas were to reward children for eating fruits and vegetables and to use presidential authority. Some regional, age, and gender patterns were found. Findings support the potential impact on health education of the 5 A Day Virtual Classroom and of interventions based on communications technology.

The United States Department of Agriculture implemented the Fresh Fruit and Vegetable Pilot Program in 2006-2007. The purpose of the program was to increase fruit and vegetable consumption outside of the lunchroom. One Houston-area high school that was received funding provided baskets of fresh fruits and vegetables daily for each classroom during this period. Davis, Weber Cullen, Watson, Konarik & Radcliffe (2009)

assessed the impact of this program on students' fruit and vegetable intake. At the end of the program, fruit and vegetable intake surveys were distributed to students at the intervention school and at a comparison high school. Completed, anonymous surveys were received from 34 percent of the intervention group and 42 percent of the comparison school students. The students were classified as to whether they met the recommended daily intake of fruit, 100 percent fruit juice, and vegetables. The probability of meeting the recommendations was assessed with logistic regression analyses, controlling for sex, age, and ethnicity. Compared with the comparison control school students, intervention school students were more likely to report eating fruit and drinking 100 percent fruit juice at least two times per day and consuming total fruit, juice, and vegetables five or more times per day in the preceding seven days. More intervention school students than comparison school students reported eating fruit at least one time per day. There were no group differences in vegetable intake. Results indicated fresh fruit and vegetable distribution programs provide the opportunity for students to taste a variety of fruits and vegetables and may improve consumption of these foods by adolescents.

The consumption of fruits and vegetables has been shown by nutritionists to have preventative effects with regard to cardiovascular disease and cancer. Recent promotions in New Zealand have emphasized the need to eat '5+' a day for better health. Hill, Casswell, Maskill, Jones & Wyllie (1998) examined the interaction between 20 New Zealand teenagers and their parent responsible for food purchasing to identify factors affecting teenagers' consumption of and attitudes towards fruit and vegetables, both at home and as a snack away from home. Although the teenagers believed fruits and



vegetables were ‘good for you’, their consumption was affected by the teenagers’ perceptions of the desirability of different foods, and the degree of independence or parental control in different eating situations. The authors suggested several possible health promotion and marketing strategies to enhance fruit and vegetable consumption.

During the 2004-2005 school year, the Mississippi Department of Education Child Nutrition Program initiated the Mississippi Fresh Fruit and Vegetable Pilot Program (CDC, 2006). The program was designed to: 1) increase student access to fresh fruits and vegetables; 2) increase the degree of student preference for fruits and vegetables; and 3) increase fruit and vegetable consumption. The schools distributed fresh fruits and vegetables during the school day and provided nutrition education activities to promote and support consumption of fruits and vegetables. A pretest was given in the fall and a posttest was given in the spring to evaluate the program. The survey assessed changes in the following during the school year: 1) the variety of fruits and vegetables ever eaten by students, 2) their attitudes toward fruits and vegetables, 3) their willingness to try fruits and vegetables, 4) their degree of preference for a familiarity with fruits and vegetables, and 5) their intentions to eat fruits and vegetables. The researchers collected information from eighth grade and tenth grade students about dietary intake for the previous 24 hours. Results indicated the variety of fruits and vegetables “ever eaten” increased significantly among students in all three grades. Only 8<sup>th</sup> grade students, however, had significant increases in positive attitudes toward eating fruits and vegetables (e.g., they indicated they believed they could eat more fruit and that they were willing to try new fruit). Degree of preference for fruit increased significantly among eighth grade and tenth grade students. Degree of preference for vegetables

decreased significantly among fifth grade and eighth grade students. Intention to eat fruit increased significantly among tenth grade students, but not among fifth grade or eighth grade students. Student consumption of fruit in the school and overall increased significantly by 0.34 and 0.61 servings per day, among the eighth grade and tenth grade students who participated in dietary recall interviews. Student consumption of vegetables in school decreased significantly, but consumption of vegetables overall did not change.

### **Summary**

A review of the literature clearly indicates the majority of adolescents do not consume adequate fruits and vegetables. Fruits and vegetables provide essential nutrients. Diets low in fruits and vegetables have been associated with obesity and many chronic diseases. Identifying age-appropriate ways to increase fruits and vegetables among adolescents is warranted.

## **CHAPTER THREE**

### **METHODOLOGY**

The purpose of this quasi-experimental study was to determine the impact of five 50-minute nutrition lessons and cooking demonstrations/labs developed by this researcher on high school students' knowledge, attitude, and food consumption behavior of fruits and vegetables. This chapter will describe the methods used to conduct the study.

#### **Institutional Review Board**

This study was approved by the Institutional Review Board at Ball State University as an expedited study, effective September 24, 2010 through September 23, 2011 (Appendix A-1). The researcher conducting this analysis successfully completed the Collaborative Institutional Training Initiative training (Appendix A-2).

#### **Sample**

Subjects in this study included a convenience sample of the 41 high school students (grades 9-12) who had enrolled in one of two Family and Consumer Sciences classes at Crothersville Junior/Senior High School in Crothersville, Indiana, in the spring

semester of 2011. The control group (n=19) consisted of those students enrolled in the Adult Roles class; the experimental group (n=22) consisted of those students enrolled in the Nutrition and Wellness class. Both classes were taught by the Family and Consumer Sciences (FACS) teacher, Mrs. Kaye Durham, the mother of this researcher.

## **Instruments**

An identical *Fruit and Vegetable Student Survey* was used as a pretest (Appendix B-1), posttest (Appendix B-2), and follow-up test (Appendix B-3) to assess students' knowledge about, attitude toward, and consumption of fruits and vegetables. A series of five lesson plans, developed by this researcher, was given to the experimental group (Appendix C) during the second week of January 2011.

### *Fruit and Vegetable Student Survey*

The *Fruit and Vegetable Student Survey*, used as a pretest, posttest, and follow-up test, contained multiple-choice, true-false, and fill-in-the-blank questions. The only difference between the three surveys was the cover sheet that indicated whether the test was the pretest, posttest, or follow-up test. The survey was used to assess the control and treatment groups' knowledge about, attitudes toward, and consumption patterns of fruits and vegetables prior to the implementation of the lesson plans in the experimental group, immediately after the lessons were completed, and nine weeks after the completion of the lessons. The questions used in the survey were adopted from the Mississippi Fruit and Vegetable Pilot Student Survey (CDC, 2006) and the Guide to Good Food (Guide to Good Food, 2000).

The *Fruit and Vegetable Student Survey* was evaluated for face and content validity by four registered dietitians and a licensed Family and Consumer Sciences teacher-educator. The survey questions measured the students' knowledge about the vitamins and minerals found in fruits and vegetables, standard serving sizes, the proper way to store fruits and vegetables, the seasonality of fruits and vegetables, and methods used to cook fruits and vegetables. The students' attitude toward fruits and vegetables were measured by asking the students to indicate the types of fruits and vegetables they would eat and how they would feel about eating specific fruits and vegetables. The students' fruit and vegetable consumption patterns were assessed by asking how many servings the student typically eats per day, how often they choose fruits and vegetables at lunch, and what types of fruits and vegetables they have eaten.

### *Lesson Plans*

Upon completion of the pre-test, the five lesson plans (Appendix C) were taught to the experimental group (Nutrition and Wellness class) for five consecutive days by the Crothersville Junior/Senior High School FACS teacher, Mrs. Kaye Durham. After completing the lessons, the learner was expected to be able to: 1) state the benefits of eating a variety of colorful fruits and vegetables; 2) define the term "phytochemical;" 3) describe the benefits of phytochemicals found in fruits and vegetables; 4) state how many servings of fruits and vegetables are recommended for teens; 5) describe the quantity of a fruit or vegetable that is considered "a serving;" 6) prepare a variety of new recipes that will incorporate more fruits and vegetables into the student's daily diet.

Lesson one (Appendix C-1) focused on the current Food Guide Pyramid (MyPyramid) and, specifically, how fruits and vegetables fit in the Food Guide Pyramid, including how many servings are recommended for various age groups, and the quantity of a food that comprises an appropriate serving size. The students were exposed to the official web site of MyPyramid, [www.mypyramid.gov](http://www.mypyramid.gov), and, in a group discussion, reviewed the food guide pyramid and the different food groups. The instructor provided each student with a handout displaying the food guide pyramid and gave the students a worksheet to complete that focuses on the different colors of the food guide pyramid, the different widths of the pyramid, and the different food groups of the pyramid, while they navigated the Food Guide Pyramid website.

Lesson two (Appendix C-2) focused on the importance of eating a rainbow of colors of fruits and vegetables and described the types of fruits and vegetables that fit into different color categories. The lesson addressed how the students prepare the fruits and vegetables they eat, and their favorite fruits and vegetables. At the conclusion of the lesson, the students were offered a vegetable tray with dip that included cauliflower, broccoli, baby carrots and cherry tomatoes.

Lesson three (Appendix C-3) described the benefits of the nutrients, fiber, and phytochemicals in fruits and vegetables. The instructor displayed various types of fruits and vegetables and asked the students what important vitamins and minerals are in each of the fruits and/or vegetables. The instructor reviewed the daily number of servings the students should be eating and what specific vitamins and minerals fruits and vegetables supply for the body. The instructor also discussed fiber, its benefits, and why it is important for the body. At the conclusion of the lesson, the instructor demonstrated a stir

fry recipe that included zucchini, snap peas, sweet red peppers and onions that the students were able to taste-test.

The fourth lesson (Appendix C-4) taught students how to incorporate vegetables into their daily diet. The instructor asked the students to give examples of how they incorporate vegetables into their diet, writing those examples on the chalkboard. The instructor then asked the class to brainstorm other examples of how to incorporate vegetables into their diet. The students got into their appropriate labs and prepared a vegetable pizza that included raw broccoli, cucumber, tomatoes and shredded carrots.

The fifth lesson (Appendix C-5) helped the students learn how to incorporate more fruits into their daily diet. Students were asked to state their favorite fruits and describe how they like them prepared. The instructor asked the students to give examples of how they incorporate fruit into their diet, writing those examples on the chalkboard. The instructor then asked the class to brainstorm other examples of how to incorporate fruits into their diet. The students got into their appropriate labs and made a fruit smoothie with various types of fruits (e.g., pineapple, strawberries and peaches).

### **Letter of Permission**

A letter of permission to conduct the study was obtained from the principal of the Crothersville Junior/Senior High School in Crothersville, Indiana (Appendix D). The letter was obtained prior to conducting the study.

### **Letter of Information**

A letter of information was sent home with the students (Appendix E). The letter described the reason for the study, the risks of the study, and how the data will be

collected. The letter also informed parents about who was conducting the survey and how to reach the researcher if they had questions or concerns.

## **Methods**

Once permission was obtained from the principal of Crothersville Junior/Senior High School (Appendix D), and a letter of information describing the procedures was sent home to the parents of the students enrolled in the Adult Roles and the Nutrition and Wellness classes (Appendix E), the classroom teacher gave the *Fruit and Vegetable Student Survey* (Appendix B-1) to the 19 students in the Adult Roles class (control group) and the 22 students in the Nutrition and Wellness class (treatment group) before the week the five lessons were taught to the treatment group (e.g., Nutrition and Wellness class). The *Fruit and Vegetable Student Survey* had a cover sheet that contained the student's name and a random alpha-numeric code; the alpha-numeric code was also written on the first page of the survey. The cover page was removed by the classroom teacher prior to sharing the results with the researcher. All data was recorded by the researcher using the alpha-numeric code, rendering the data anonymous to the researcher. The random alphanumeric code for the control group started with a "C" and the alphanumeric code for the experimental group started with an "E" to ensure the group membership did not get mixed.

Once the pretest was given, the students enrolled in the Nutrition and Wellness class in the spring semester of 2011 were given a series of five 50-minute lessons on fruits and vegetables (Appendix C). The five lesson plans covered material that would normally be taught in the Nutrition and Wellness class, but with additional depth and



more laboratory experiences where the students got to prepare and taste various fruits and vegetables. Per school policy, if a student chose not to participate in the lesson plans, he/she was sent to the principal's office to complete a homework assignment similar to what was being taught (e.g., complete the MyPyramid worksheet and write a research paper on the nutritional contribution of fruits and vegetables to the American diet). At the conclusion of the lessons, the students in both the Adult Roles and the Nutrition and Wellness classes were given the *Fruit and Vegetable Student Survey* as a posttest (Appendix B-2). The posttest had a cover sheet that contained the student's name and the same random alpha-numeric code that was on their pretest. The teacher matched each student's pretest with their posttest, removed the cover sheet with the student's name, and stapled the two tests together prior to sharing the results with the researcher for data entry and analysis.

At the end of the nine week quarter, the instructor gave the same posttest to the experimental and control group to assess their knowledge about, attitudes toward, and behavior consumptions of fruits and vegetables (Appendix B-3). The results of the follow-up survey were compared to the first posttest and to the baseline data to determine retention of knowledge and identify any changes in attitudes toward or consumption of fruits and vegetables.

### **Statistical Analysis**

Data was analyzed using SPSS v.19.0 for Windows (SPSS, 2010). Descriptive statistics and frequency counts were run on all variables. Frequency counts (number and percent) were used to determine the overall prevalence of specific survey questions

among both experimental and control groups. Results of the knowledge questions were summed to create a “knowledge score.” A change in the students’ knowledge score within groups (e.g., pretest vs. posttest) was measured using a paired t-test. Changes in variables between groups (e.g., control vs. treatment) were analyzed using ANOVA. A shift in the students’ attitudes toward fruits and vegetables and their food consumption behavior was analyzed by comparing the results of the matched pretest to the posttest using Wilcoxon Signed Ranks test and crosstabs with Chi square for non-parametric data. Statistical significance was set at  $p \leq 0.05$ .

### **Summary**

This quasi-experimental study assessed the knowledge, attitude, and behavior of 41 high school students toward fruits and vegetables. Lesson plans, created by the researcher, were intended to teach the students’ the importance of fruits and vegetables in the diet, how many servings of fruits and vegetables to have each day, and how to incorporate fruits and vegetables in their daily diet in an attempt to increase the students’ consumption of fruits and vegetables. The impact of the lessons, both immediately upon completion of the unit and nine weeks after the lessons, were measured using the *Fruit and Vegetable Student Survey* in both a control and treatment group.

## **CHAPTER 4**

### **RESULTS**

The purpose of this quasi-experimental study was to determine the impact of five 50-minute nutrition lessons and cooking demonstrations/labs developed by this researcher on high school students' knowledge, attitude, and food consumption behavior of fruits and vegetables. This chapter will present the results obtained throughout the implementation of the study.

#### **Subjects**

The subjects for this study consisted of a convenience sample of 41 students from Crothersville Junior/Senior High School who were enrolled in Mrs. Kaye Durham's Nutrition and Wellness (n=22) or Adult Roles (n=19) class spring semester of 2011 (Table 1). The treatment group consisted of the 22 students (13 male; 9 female), who were enrolled in the Nutrition and Wellness class. The treatment group was a mix of sophomores (n=6), juniors (n=10) and seniors (n=6). Subjects in the treatment group ranged in age from 15 to 19 years, with a mean age of  $16.6 \pm 1.1$  years.

The control group consisted of the 19 students enrolled in Mrs. Kaye Durham's Adult Roles class. All of the students in the control group were sophomores and all 19

were male. Subjects in the control group ranged in age from 15 to 17 years, with a mean age of  $15.7 \pm 0.7$  years (Table 1).

**Table 1. Description of Subjects in the Control and Treatment Groups (n=41).**

Variable	Control (n = 19)	Treatment (n = 22)
Age, Mean (yrs)	$15.7 \pm 0.7$	$16.6 \pm 1.1$
Subject Age (yrs)	<u>Number (%)</u>	<u>Number (%)</u>
15	7 (36.8%)	3 (13.6%)
16	10 (52.6%)	7 (31.8%)
17	2 (10.5%)	9 (40.9%)
18	0	2 (9.1%)
19	0	1 (4.5%)
Gender		
Male	19 (100%)	13 (59.1%)
Female	0 (0%)	9 (40.9%)
Classification		
Sophomore	19 (100%)	6 (27.3%)
Juniors	0 (0%)	10 (45.5%)
Seniors	0 (0%)	6 (27.3%)
Previous Course		
Yes	5 (26.3%)	8 (36.4%)
No	14 (73.7%)	14 (63.6%)

Five (26.3%) of the 19 students in the control group, and eight (36.4%) of the 22 students in the treatment group, reported having taken a food/nutrition course prior to participating in this study (Table 1). This class would have had to have been taken in middle school (6<sup>th</sup> -8<sup>th</sup> grade), as no student in the control group had previously taken Mrs. Durham's Nutrition and Wellness class at the high school level.

### RQ#1: Nutrition Knowledge

The first research question examined whether completion of a five-day experiential unit that emphasizes nutrition knowledge and preparation methods of fruits and vegetables would be associated with an increased knowledge about fruits and vegetables, both at the completion of the unit and at a two month follow-up period.

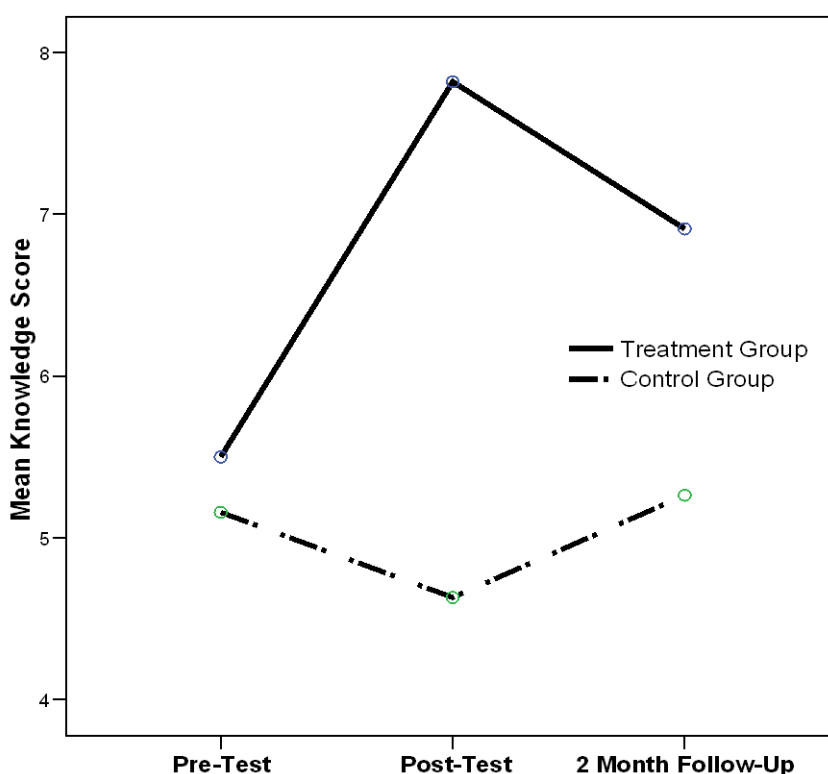
At baseline, the control group (n=19) had a mean score of  $5.16 \pm 1.89$  out of ten possible points, while the treatment group (n=22) had a mean score of  $5.50 \pm 1.43$ . Analysis of variance (ANOVA) indicated there was no statistical difference between the control and the treatment group at baseline ( $F=0.431$ ;  $p = 0.515$ ) (Table 2) (Figure 1).

After receiving the five nutrition education lessons, the mean score for the treatment group rose significantly to  $7.82 \pm 1.50$ , while the score for the control group declined, but non-significantly, to  $4.63 \pm 2.43$ . Results indicated a significant increase in the overall nutrition knowledge score between pretest and posttest for the treatment group ( $F=26.27$ ;  $p = 0.000$ ) (Table 2) (Figure 1). No differences in the posttest scores were detected by gender (males:  $7.7 \pm 1.4$ ; n=13 vs. females:  $8.0 \pm 1.7$ ; n=9) ( $F=.215$ ;  $p=.648$ ).

**Table 2. Comparison of the Mean Fruit and Vegetable Knowledge Score Between Experimental and Control Groups at Pre-Test, Post-Test, and Two-Month Follow-Up.**

	<b>Treatment (n=22)</b>	<b>Control (n=19)</b>	<b>F</b>	<b>p</b>
Pre	$5.50 \pm 1.43$	$5.16 \pm 1.89$	0.431	.515
Post	$7.82 \pm 1.50$	$4.63 \pm 2.43$	26.27	.000
Follow-Up	$6.91 \pm 2.07$	$5.26 \pm 2.90$	4.46	.041
Paired $t_{\text{post/follow-up}}$	1.92	0.77		
p	.069	.454		

Two months after completing the five nutrition education lessons, ANOVA indicated a statistically significant difference between the control group and the treatment group ( $6.71 \pm 2.07$  vs.  $5.26 \pm 2.90$ ; paired- $t = 4.46$ ;  $p = .041$ ). Within the treatment group, a paired  $t$ -test indicated no significant difference between the post-test knowledge score and the follow-up knowledge score, indicating the retention of knowledge learned ( $7.82 \pm 1.50$  vs.  $6.91 \pm 2.07$ ;  $t = 1.92$ ,  $p = .069$ ). Paired  $t$ -test also indicated the treatment group scored significantly higher on the follow-up test than on the pretest ( $5.5 \pm 1.4$  vs.  $6.9 \pm 2.1$ ;  $t = 3.58$ ,  $p = 0.02$ ). There was no change in the knowledge score for the control group from post-test to the nine-week follow-up testing period ( $4.63 \pm 2.43$  to  $5.26 \pm 2.90$ ; paired- $t = 0.77$ ;  $p = .454$ ) (Table 2) (Figure 1).



**Figure 1. Mean Knowledge Scores Comparing the Pretest, Post Test, and Two-Month Follow Up for the Control and Treatment Groups**

Only one question was correctly answered by all 22 students in the treatment group on the pre-assessment (e.g., “Fruit is a good source of many vitamins and minerals; Table 3). On the post assessment, every question was answered correctly by at least 77 percent of the students, with the exception of the two questions about fresh fruits being available at times other than when it is “in season” (63.6% correct) and the role of vegetable skin and pulp providing fiber to aid digestion (72.7 percent; Table 3).

**Table 3. Percent of Students in the Treatment Group who Answered the Knowledge Questions Correctly at Pre- and Posttest (n=22).**

Question	Pretest (%)	Posttest (%)
Fruits are only available when they are “in season.” (false)	45.5	63.6
Fruit is a good source of many vitamins and minerals. (true)	100.0	100.0
Most vegetables are low in calories. (true)	77.3	95.5
Vegetables cooked in a microware oven are <i>less nutritious</i> than others. (false)	36.3	77.3
Which of these fruits is a good source of vitamin A? (peaches)	18.2	86.4
For a 2000 calorie diet, how many cups of fruits and vegetables, combined, should you eat every day? (4½ c.)	36.4	81.8
Vegetable skin and pulp provides ____ to aid digestion and help keep you ‘regular’ (fiber).	40.9	72.7
Some nutrients in vegetables are ____ and dissolve in the cooking liquid (water-soluble).	50.0	86.4
____ are an excellent source of vitamin C (Oranges)	86.4	95.5
About how many grams of fiber are recommended every day (20-35 grams)	59.1	77.3

Cronbach's alpha was conducted on the post-test scores for the treatment group to determine the test's reliability. Results indicated an internal consistency of 0.73, indicating an acceptable level of reliability (e.g., a reliability coefficient of .70 or higher is considered "acceptable" in most social science research situations). A test-retest correlation conducted on the pre-test and post-test for the control group was  $r = 0.52$ .

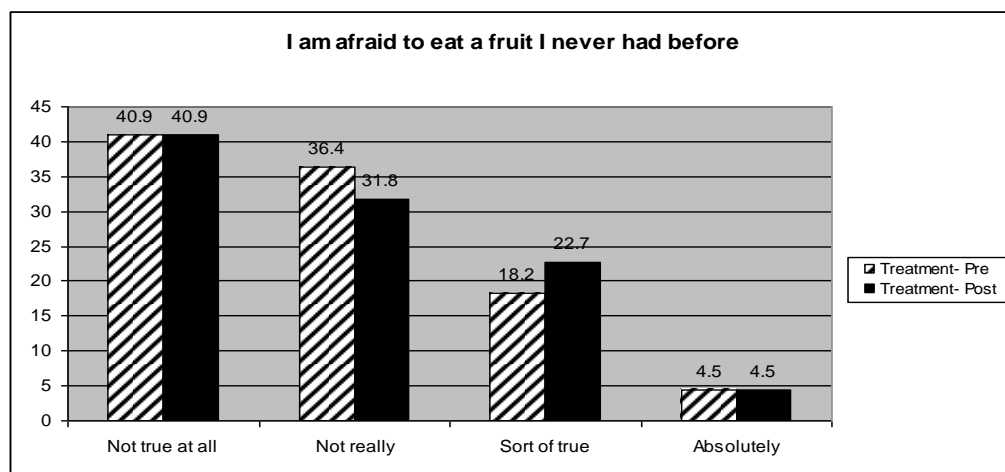
### **RQ#2: Attitudes Toward Fruits and Vegetables**

The second research question examined the impact of the five-day nutrition education unit on the attitude of these high school students toward fruits and vegetables. Several pre- and post-test questions were asked to determine the students attitude toward fruits and vegetables.

The students were asked a series of questions that asked "How true are these statements for you?" on the pretest and posttest in an effort to measure their attitude toward fruits and vegetables. Wilcoxon Signed Ranks Test indicated no statistical change in response to any of the six questions in the treatment group after completion of the five day intervention.

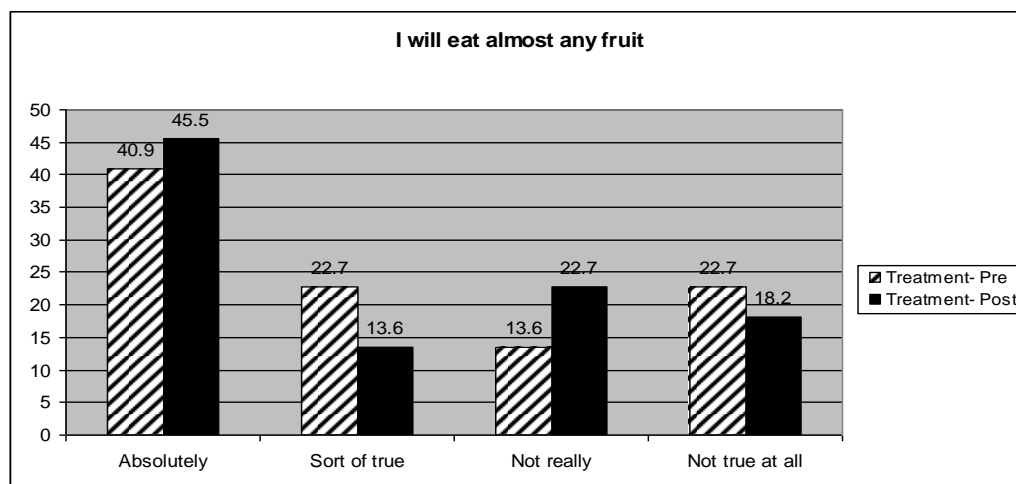
The first attitude question asked if they were "afraid to eat a fruit I have never tried before." Almost half of the students (40.9%) reported this was "not true at all" on both on the pretest and posttest, while 4.5 percent reported that was "absolutely true" both on the pretest and posttest (Figure 2). Wilcoxon Signed Ranks Test indicated no shift in attitude from pre-test to post-test after completion of the five-day intervention ( $Z = .213$ ;  $p=0.832$ ).





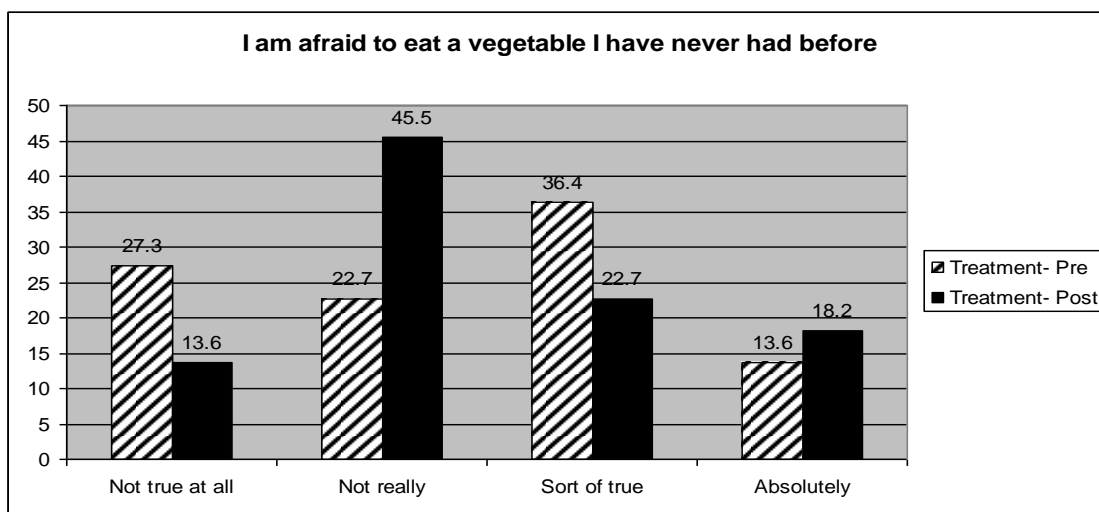
**Figure 2.** Comparison of Pre-and Posttest Responses in the Treatment Group to the Statement “I am afraid to eat a fruit I never had before” (n=22).

A second question asked if the students would “eat almost any fruit.” Almost half (40.9%) reported they would “Absolutely” eat any fruit on the pretest; the percent rose insignificantly to 45.5 percent on the posttest. Almost one-fourth (22.7%) of the students reported this was “not true at all” on the pretest; the number decreased insignificantly to 18.2 percent on the posttest (Figure 3). No statistical shift in attitude from pre-test to post-test after completion of the five-day intervention was detected ( $Z=-.264$ ;  $p=0.792$ ).



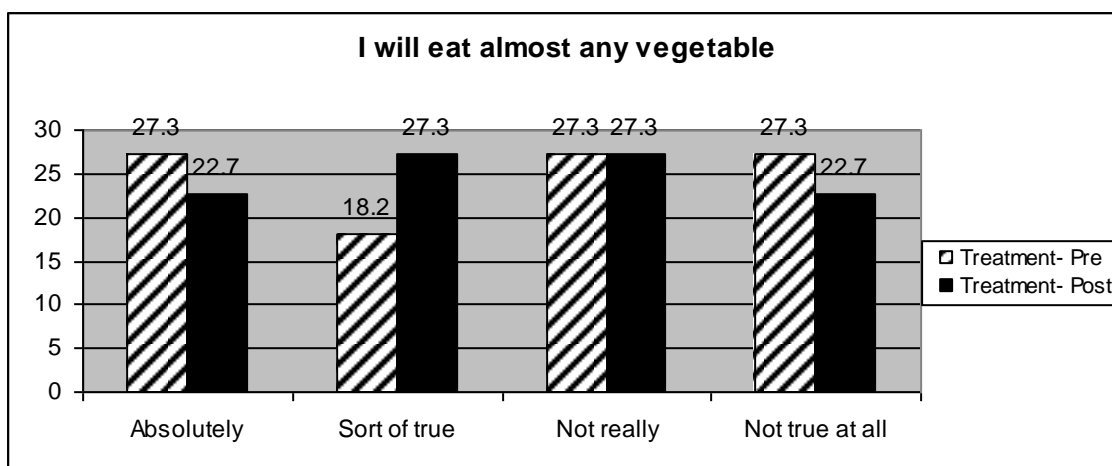
**Figure 3.** Comparison of Pre-and Posttest Responses in the Treatment Group to the Statement “I will eat almost any fruit” (n=22).

A third question asked if the students “were afraid to eat a vegetable they had never tried before.” Approximately one in ten students (13.6%) reported that was absolutely true on the pretest; the percent increased insignificantly to 18.2 percent on the posttest (Figure 4). Students appeared to have shifted their attitude from that of “not true at all” at the pretest (27.3%) to “not really” (45.5%) on the posttest, indicating a trend toward being more hesitant to try a new vegetable, although the change was not statistically significant ( $Z=-.312$ ;  $p=0.755$ ).



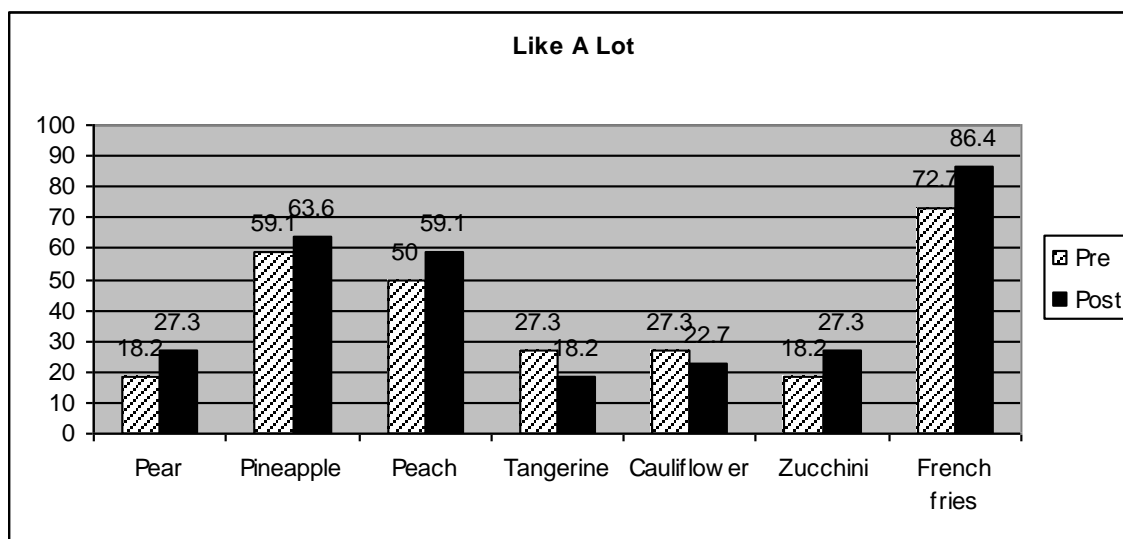
**Figure 4.** Comparison of Pre-and Posttest Responses in the Treatment Group to the Statement “I am afraid to eat a vegetable I have never tried before” (n=22).

A fourth question asked if the students “would eat almost any vegetable.” The class was evenly divided in their response on the pretest, with 27.3 percent of the students responding “absolutely,” “not really”, and “not true at all,” while 18.2 percent responded “sort of true” (Figure 5). On the post-evaluation, little change was observed and no statistically significant differences were detected ( $Z=-.046$ ;  $p=0.963$ ).



**Figure 5.** Comparison of Pre- and Posttest Responses in the Treatment Group to the Statement "I will eat almost any vegetable" (n=22).

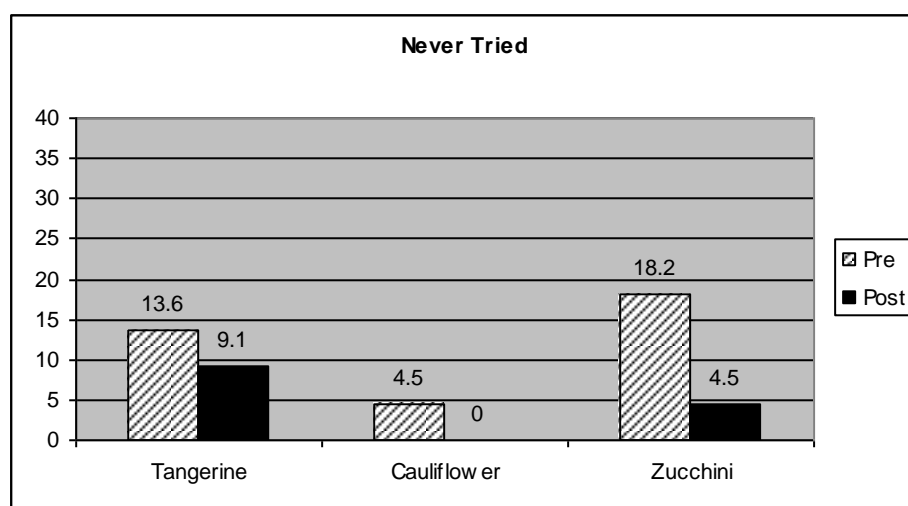
The students were asked to indicate how they felt about eating specific fruits and vegetables. The most popular fruits that were "liked a lot" by more than half of the students were pineapple (59% pretest; 64% posttest), peaches (50% pretest; 59% posttest) and, unfortunately, French Fries (73% pretest; 86% posttest) (Figure 6)



**Figure 6.** Comparison of Pre- and Posttest Response in the Treatment Group Indicating the Fruits and Vegetables Students "Like a Lot" (n=22).

The vegetables and fruits most disliked (e.g., students responded either “Don’t Like” or “Hate It!”) on the pretest were sweet red peppers (36.4%), tangerines (31.8%), broccoli (31.8%), pears (27.3%), and cauliflower (22.7%). On the posttest, the percent of students who reported they disliked (e.g., responded “Don’t Like” or “Hate It”) pears decreased from 27.3 percent to 18.2 percent and sweet red peppers from 36.4 percent to 22.7 percent. In addition, the number of students who reported they “hated” broccoli decreased from 18.2 percent to 9.1 percent at posttest.

Students were asked to indicate which fruits and vegetables they had never tried before. On the pretest, 13.6 percent said they never tried tangerines; this number decreased to 9.1 percent at posttest. At pretest, 4.5 percent of the students had never tried cauliflower; this number decreased to zero at posttest. Lastly, 18.2 percent of the students reported they have never tried zucchini; this number decreased to 4.5 percent on the posttest (Figure 7).



**Figure 7. Comparison of Pre- and Posttest Response in the Treatment Group Indicating Fruits and Vegetables Students had “Never Tried” (n=22).**

### **RQ#3: Consumption of Fruits and Vegetables**

The third research question examined the impact of the five-day nutrition education unit on the students' self-reported consumption of fruits and vegetables at the completion of the unit.

#### *Recommended Cups of Fruit per Day*

At the pretest, students in the treatment group (n=22) indicated they thought they should eat  $2.3 \pm 1.0$  cups of fruit per day, while the control group (n=19) reported they thought they should be eating  $2.8 \pm 0.8$  cups of fruit per day. Both of these values are higher than the two cups that are recommended in the MyPyramid for a 2000 calorie diet. ANOVA indicated there was no statistical difference between the treatment group and the control group in the amount of fruit students thought they should eat at the pretest ( $F=3.278$ ;  $p=0.078$ ) (Table 4).

At the posttest, students in the treatment group reported they should eat  $2.1 \pm 0.8$  cups of fruit per day, while the control thought they should be eating  $2.7 \pm 0.8$  cups of fruit per day. ANOVA indicated this difference between the treatment group and the control group at the posttest was statistically significant ( $F=4.832$ ;  $p=0.034$ ) (Table 4). The treatment group as a whole responded more closely to the two cups that were taught in the curriculum as the amount of fruit recommended in MyPyramid.

Although there was a reduction in the number of cups of fruit the treatment group thought they should eat each day at posttest, a paired t-test of the treatment group only indicated the reduction from  $2.3 \pm 1.0$  cups to  $2.1 \pm 0.8$  cups was not significant ( $t = 0.777$ ,  $p = .466$ ). Similarly, there was no change in the number of cups of fruit the

control group thought they should eat each day from pre-test to post-test ( $2.8 \pm 0.8$  cups vs.  $2.7 \pm 0.8$  cups;  $t = 1.14$ ;  $p = .268$ ) (Table 4).

**Table 4. Mean Cups of Fruit Students Thought they Should Eat Each Day.**

	<b>Treatment (n=22)</b>	<b>Control (n=19)</b>	<b>F</b>	<b>p</b>
Pretest	$2.3 \pm 1.0$	$2.8 \pm 0.8$	3.278	0.078
Posttest	$2.1 \pm 0.8$	$2.7 \pm 0.8$	4.832	<b>0.034</b>
Difference	-.182	-.158		
Paired-t	.777	1.143		
p	.446	.268		

#### *Recommended Cups of Vegetables per Day*

At the pretest, students in the treatment group reported they should eat  $2.1 \pm 1.0$  cups of vegetables per day, while the control group thought they should eat  $2.7 \pm 0.7$  cups of vegetables per day. These two values surrounded the actual value of 2.5 cups of vegetables per day as recommended by the MyPyramid. Despite the mean difference, ANOVA indicated there was no statistical difference between the treatment group and control group at the pretest ( $F=4.384$ ;  $p=0.043$ ) (Table 5).

At the posttest, students in the treatment group indicated they should eat  $2.2 \pm 0.8$  cups of vegetables per day, while the control group thought they should be eating  $2.4 \pm 0.9$  cups of vegetables per day. ANOVA indicated there was no statistical difference between the treatment group and the control group at posttest ( $F=0.500$ ;  $p=0.484$ ) (Table 5).

Although there was a slight increase in the number of cups of vegetables the treatment group thought they should eat each day at posttest, a paired t-test of the treatment group indicated the increase from  $2.1 \pm 1.0$  to  $2.2 \pm 0.8$  was not significant ( $t=0.777$ ,  $p = .466$ ). Similarly, a paired t-test of the control group indicated there was no change in the number of cups of vegetables the students thought they should eat each day from pre-test to post-test ( $2.7 \pm 0.8$  vs.  $2.4 \pm 0.9$ ;  $t = 1.45$ ;  $p=.163$ ) (Table 5).

**Table 5. Mean Cups of Vegetables Students Thought they Should Eat Each Day.**

	<b>Treatment (n=22)</b>	<b>Control (n=19)</b>	<b>F</b>	<b>p</b>
Pretest	$2.1 \pm 1.0$	$2.7 \pm 0.8$	4.284	<b>0.043</b>
Posttest	$2.2 \pm 0.8$	$2.4 \pm 0.9$	0.500	0.484
Difference	.100	-.316		
Paired-t	.777	1.45		
p	.346	.163		

#### *Fruits Consumed Per Day*

At the pretest, students in the treatment group reported they usually ate  $1.4 \pm 0.9$  cups of fruit per day, while students in the control group reported usually eating  $2.3 \pm 2.6$  cups of fruit per day. Students in the control group reported consuming slightly more fruit per day than currently recommended by MyPyramid (2 cups). Despite the mean difference of 0.9 servings between the groups, ANOVA indicated there was no statistical difference in the self reported consumption of fruit per day between the treatment group and the control group at the pretest ( $F=2.275$ ;  $p=0.140$ ) (Table 6).

At the posttest, students in the treatment group reported they usually consumed  $1.6 \pm 1.2$  cups of fruit per day, up slightly than at the pre-test level, while students in the control group reported they usually ate  $2.0 \pm 1.6$  cups of fruit per day, down slightly from the pre-test level. ANOVA indicated there was no statistical difference between the treatment group and the control group ( $F=1.200$ ;  $p=0.280$ ) (Table 6).

Although there was a slight increase in the number of cups of fruit the treatment group reported they usually consume at posttest, a paired t-test of the treatment group indicated the increase from  $1.4 \pm 0.8$  cups to  $1.6 \pm 1.2$  cups was not significant ( $t=0.448$ ,  $p = .659$ ), nor did it meet the recommended two cups per day. Similarly, a paired t-test of the control group only indicated there was no change in the number of cups of fruit the students reported they usually consume from pre-test to post-test ( $2.3 \pm 2.6$  vs.  $2.0 \pm 1.6$ ;  $t = 0.503$ ;  $p=.637$ ) (Table 6).

**Table 6. Mean Number of Cups of Fruit Usually Eaten per Day**

	<b>Treatment (n=22)</b>	<b>Control (n=19)</b>	<b>F</b>	<b>p</b>
Pre	$1.4 \pm 0.9$	$2.3 \pm 2.6$	2.275	0.140
Post	$1.6 \pm 1.2$	$2.0 \pm 1.6$	1.200	0.280
Difference	0.15	0.26		
Paired t	.448	.503		
p	.659	.637		

#### *Vegetables Consumed Per Day*

At the pretest, students in the treatment group reported they usually ate  $1.4 \pm 1.3$  cups of vegetables per day, while the control group reported usually eating  $2.0 \pm 1.8$  cups



per day. ANOVA indicated there was no statistical difference between the treatment group and the control group in the number of cups of vegetables the students usually ate each day at the pretest ( $F=1.462$ ;  $p=0.234$ ) (Table 7).

At the posttest, students in the treatment group reported they usually ate  $1.6 \pm 1.4$  cups of vegetables per day, while the control group reported usually eating  $1.7 \pm 1.2$  cups of vegetables per day. Neither of the groups came close to consuming the 2.5 cups recommended by MyPyramid and emphasized in the five-day curriculum. ANOVA indicated there was no statistical difference between the number of cups of vegetables usually consumed by the treatment group and the control group at the posttest ( $F=0.194$ ;  $p=0.662$ ) (Table 7).

**Table 7. Mean Number of Cups of Vegetables Usually Eaten per Day.**

	<b>Treatment (n=22)</b>	<b>Control (n=19)</b>	<b>F</b>	<b>p</b>
Pre	$1.4 \pm 1.3$	$2.0 \pm 1.8$	1.462	0.234
Post	$1.6 \pm 1.4$	$1.7 \pm 1.2$	0.194	0.662
Difference	0.18	0.32		
Paired t	.557	.637		
p	.584	.532		

Although there was a slight increase in the number of cups of vegetables the treatment group reported they usually consume at posttest, a paired t-test indicated the increase from  $1.4 \pm 1.3$  cups to  $1.6 \pm 1.4$  cups in the treatment group was not significant ( $t=0.557$ ,  $p = .584$ ), nor did it meet the recommended two cups of vegetables per day.

Similarly, a paired t-test of the control group indicated there was no change in the number of cups of vegetables the students reported they usually consume from pre-test to post-test ( $2.0 \pm 1.8$  vs.  $1.7 \pm 1.2$ ;  $t = 0.637$ ;  $p = .532$ ) (Table 7).

#### *Choose Fruit as a Snack*

At baseline, there was no difference between the control group and the treatment group in response to the question “How often would you choose fruit as a snack instead of chips or candy?” ( $F = 0.331$ ;  $p = 0.568$ ). The majority of students in both groups responded “I would sometime” (Treatment Group: 59%; Control Group: 47%). Approximately one-quarter of the students (27.3% treatment; 26.8% control) indicated they would choose fruit as a snack “most of the time.” Only one student in each group indicated they would “never” choose fruit as a snack. After receiving the five nutrition education lessons, there was no change in the percent of students who reported they would choose fruit as a snack instead of chips or candy in either the treatment or the control groups ( $F = 0.046$ ;  $p = 0.831$ ).

#### *Choose Vegetables as a Snack*

At baseline, there was no difference between the control group and the treatment group in response to the question “How often would you choose vegetables as a snack instead of chips or candy?” ( $F = 0.331$ ;  $p = 0.568$ ), although the answers were much more dispersed than they were for fruit. The majority of students in both groups responded “I would sometime” (Treatment Group: 36%; Control Group: 47%). Twenty-three percent of the students in the treatment group, and 16 percent of the students in the control group, indicated they would choose vegetables as a snack instead of chips and candy “most of

the time.” In contrast to fruits, four students in each group indicated they would “never” choose vegetables as a snack. After receiving the five nutrition education lessons, there was no change in the percent of students who reported they would choose vegetables as a snack instead of chips or candy in either the treatment or the control groups ( $F=0.217$ ;  $p=0.644$ ).

#### *Select New Fruit if Offered*

At baseline, 41 percent of the students in the treatment group, and 37 percent of the students in the control group, reported they would try a new fruit if it was served with the school lunch. There was no statistical difference in the distribution at baseline ( $\chi^2 = 2.04$ ,  $p = 0.360$ ). After the completion of the five-day nutrition unit, the percent who responded “yes” from the treatment group increased from 41 percent to 68 percent ( $n=15$ ), while the percent for the students in the control group remained the same (31.6%;  $n=6$ ) (Table 8). The chi square analysis indicated a trend toward statistical difference between the groups at post assessment, with the treatment group indicating a greater willingness to try a new fruit ( $\chi^2 = 5.73$ ,  $p = 0.057$ ).

#### *Select New Vegetable if Offered*

At baseline, only one-quarter (27%;  $n=6$ ) of the treatment group, and ten percent ( $n=2$ ) of the control group, said they would try a new vegetable if it was served with lunch (Table 8). The majority of students indicated their response as “maybe” (Treatment:  $n=9$ , 41%; Control:  $n=12$ , 63%). There was no statistical difference in the distribution at baseline ( $\chi^2 = 2.56$ ,  $p = 0.279$ ). After the five-day curriculum, one more person in the treatment group ( $n=7$ ; 32%) and two more students in the control group

(n=4; 21%) indicated they would try a new vegetable if it was served at lunch (Table 8). Nonetheless, there was no statistical difference in the distribution at posttest ( $\chi^2 = 0.602$ ;  $p = 0.740$ )

**Table 8. Percent of Students who Responded “Yes” to the Statement “If a new fruit or vegetable was served with your lunch today, would you try it?”**

Percent Who Responded “Yes”				
		Treatment (n=22)	Control (n=19)	
<u>Fruit</u>		% (N)	%	(N)
Pre		40.9 (9)	36.8	(7)
Post		68.2 (15)	31.6	(6)
<u>Vegetable</u>				
Pre		27.3 (6)	10.5	(2)
Post		31.8 (7)	21.1	(4)

#### *Tried a New Fruit or Vegetable Lately*

At baseline, 27.3 percent of the treatment group (n=6), and 15.8 percent of the control group (n=3), indicated they had tried a new fruit lately. There was no statistical difference in the distribution at baseline ( $\chi^2 = .785$ ,  $p = 0.376$ ). At posttest, despite being exposed to a variety of fruits during the nutrition education lessons, only 22.7 (n=5) percent of the treatment group, and 15.8 percent of the control group (n=3), indicated they had tried a new fruit lately (Table 9). These results are not statistically different ( $\chi^2 = .312$ ,  $p = 0.576$ ).

At baseline, 13.6 percent (n=3) of the treatment group, and 15.8 percent (n=3) of the control group, indicated they had tried a new vegetable lately. There was no statistical difference in the percent of students who had tried a new vegetable between

groups at baseline ( $\chi^2 = 2.56$ ,  $p = 0.279$ ). At post-test, the number of students in the treatment group who indicated they had tried a new vegetable increased to 22.7 percent ( $n=5$ ), while the percent in the control group remained the same (15.8%;  $n=3$ ) (Table 9). Nonetheless, despite the five-day nutrition curriculum that included several recipes that highlighted vegetables, there was no statistical difference in the distribution of students who had tried a new vegetable recently at the post-test period ( $\chi^2 = .312$ ,  $p = 0.576$ ).

**Table 9. Percent of Students who Responded “Yes” to the Statement “I Have Tried a New Fruit or Vegetable Lately.” ( $n=40$ ).**

<b>Percent Tried New Fruit or Vegetable</b>				
	<b>Treatment (<math>n=22</math>)</b>		<b>Control (<math>n=19</math>)</b>	
<b><u>Fruit</u></b>	<b><u>%</u></b>	<b><u>(N)</u></b>	<b><u>%</u></b>	<b><u>(N)</u></b>
Pre	27.3	(6)	15.8	(3)
Post	22.7	(5)	15.8	(3)
<b><u>Vegetable</u></b>				
Pre	13.6	(3)	15.8	(3)
Post	22.7	(5)	15.8	(3)

#### *Eat School Lunch Fruit*

At baseline, the majority of students in both the control and treatment groups indicated they ate the fruit that was offered with the school lunch either “never” or only “1-2 days per week” (Treatment: 68%;  $n=15$ ; Control: 53%;  $n=10$ ). Only four students in both the control and treatment group indicated they would eat the fruit every day. There was no statistical difference in the distribution at baseline ( $\chi^2 = 2.21$ ,  $p = 0.529$ ).

Analysis of the posttest data indicate the number of students in the treatment group who indicated they ate the fruit offered with the school lunch either “never” or only “1-2 days per week” increased from 68 percent at baseline to 77 percent (n=17). The percent of students in the control group who would never or hardly ever eat the fruit remained constant at 53 percent. There was no difference between the groups at the end of the treatment period ( $\chi^2 = 3.35$ ,  $p = 0.340$ ).

#### *Eat School Lunch Vegetables*

At baseline, the majority of students in both the control and treatment groups indicated they ate the vegetables that were offered with the school lunch either “never” or only “1-2 days per week” (Treatment: 77%; n=17; Control: 53%; n=10). Only two students in the treatment group (9%) and three students in the control group (16%) indicated they would eat the vegetable offered every day. There was no statistical difference in the distribution at baseline ( $\chi^2 = .820$ ,  $p = 0.845$ ).

Analysis of the posttest data indicate the number of students in the treatment group who indicated they ate the vegetables offered with the school lunch either “never” or only “1-2 days per week” decreased by one student, from 77 percent at baseline to 73 percent (n=16). The percent of students in the control group who would never or hardly ever eat the vegetables offered with the school lunch remained constant at 53 percent. There was no difference in the distribution pattern of the percent of students who ate the vegetables provided with the school lunch between the groups at the end of the treatment period ( $\chi^2 = 2.98$ ,  $p = 0.395$ ).

### *Pack Fruit in Lunch*

At baseline, the majority of students in the treatment group (73%) indicated they packed a fruit for lunch. Of these, 14 percent said they packed a fruit every day, 27 percent packed a fruit 3-4 days per week, and 32 percent said they packed a fruit 1-2 days per week. A similar distribution was seen in the control group where 58 percent of the students indicated they either packed a fruit with their lunch every day (21%), 3-4 days per week (5%) or 1-2 days per week (32%). One quarter of the students in the treatment group (27%), and almost half of the students in the control group (42%), indicated they never pack a fruit with their lunch. There was no statistical difference between the groups at the post-test evaluation ( $\chi^2 = 3.878$ ,  $p = 0.275$ ).

At the completion of the five-day nutrition lessons, the same percent (73%) of students in the treatment group indicated they packed a fruit with their lunch. Of these, 9 percent said they packed a fruit every day, 32 percent said they packed a fruit 3-4 days per week, and 32 percent said they packed a fruit 1-2 days per week. A similar distribution was seen in the control group where 79 percent of the students indicated they pack a fruit with their lunch. Of these, 21 percent said they packed a fruit with their lunch every day, 21 percent packed a fruit 3-4 days per week, and 37 percent said they packed a fruit 1-2 days per week. At the post-assessment period, 27 percent of the students in the treatment and 21 percent of the students in the control group indicated they never pack a fruit with their lunch. There was no statistical difference between the groups at the post-test evaluation ( $\chi^2 = 1.67$ ,  $p = 0.643$ ).

### *Pack Vegetables in Lunch*

At baseline, slightly more than half of the students in the treatment group (59%) indicated they pack a vegetable with their lunch. Of these, 14 percent said they packed a vegetable every day, 14 percent packed a vegetable 3-4 days per week, and 32 percent said they packed a vegetable 1-2 days per week. A similar distribution was seen in the control group where 53 percent of the students indicated they pack a vegetable with their lunch. Of these, 21 percent said they packed a vegetable every day, 16 percent packed a vegetable 3-4 days per week, and another 16 percent said they packed a vegetable 1-2 days per week. Forty-one percent of the students in the treatment group, and 32% of the students in the control group, indicated they never pack a vegetable with their lunch. There was no statistical difference in the distribution between the groups at baseline ( $\chi^2 = 1.53$ ,  $p = 0.675$ ).

At the completion of the five-day nutrition lessons, the responses were exactly the same as during the pretest period. Specifically, 59 percent of the students in the treatment group (59%) indicated they pack a vegetable with their lunch. Of these, 14 percent packed a vegetable every day, 14 percent packed a vegetable 3-4 days per week, and 32 percent packed a vegetable 1-2 days per week. A similar distribution was seen in the control group where slightly more students (68%) indicated they pack a vegetable with their lunch. Of these 11 percent packed a vegetable every day, 26 percent packed a vegetable 3-4 days per week, and 32 percent packed a vegetable 1-2 days per week. Forty-one percent of the students in the treatment group, and 32 percent of the students in the control group, indicated they never pack a vegetable with their lunch at the post-



assessment. There was no statistical difference in the distribution between the groups at the post-assessment period ( $\chi^2 = 1.16$ ,  $p = 0.762$ ).

### **Summary**

Overall, the results of this five-day intervention that focused on increasing students' knowledge about, attitude toward, and consumption of fruits and vegetables are disappointing. Although the intervention was associated with a statistically significant increase in knowledge about fruits and vegetables at the end of the unit, with a retention of the knowledge in the treatment group two months after the intervention, and knowledge of the number of cups of fruit a person should eat each day, no statistically significant changes were observed in the students' attitude toward, or consumption of, fruits and vegetables. There was a statistical trend indicating a greater willingness of the treatment group to try a new fruit ( $\chi^2 = 5.73$ ,  $p = 0.057$ ) and there was a decrease in the percent of students in the treatment group who indicated they had tried cauliflower and zucchini at the end of the intervention. No other statistically significant results were observed either between or within the groups at the pre- and post-assessment periods.

## CHAPTER 5

### DISCUSSION

The purpose of this quasi-experimental study was to determine the impact of five 50-minute nutrition lessons and cooking demonstrations/labs developed by this researcher on high school students' knowledge, attitude, and food consumption behavior of fruits and vegetables. This section will discuss the results of the study in context with the current literature.

#### **RQ #1: Nutrition Knowledge**

At baseline, the control group (n=19) had a mean score of  $5.2 \pm 1.9$  out of ten possible points (52% correct), while the treatment group (n=22) had a mean score of  $5.5 \pm 1.4$  (55% correct). Analysis of variance (ANOVA) indicated there was no statistical difference between the control and the treatment group at baseline ( $F=0.431$ ;  $p = 0.515$ ).

After receiving the lessons, the mean score for the treatment group rose significantly from  $5.5 \pm 1.4$  to  $7.8 \pm 1.5$  (78% correct), while the score for the control group declined, but non-significantly, from  $5.2 \pm 1.9$  to  $4.6 \pm 2.4$  (46% correct), resulting in a significant increase in the overall nutrition knowledge score between pretest and posttest for the treatment group. No difference in knowledge was detected by gender.

Two months after completing the five nutrition education lessons, paired analysis within groups indicated the mean score for the treatment group fell non-significantly from  $7.8 \pm 1.5$  to  $6.9 \pm 2.1$ , while the score for the control group increased slightly, but insignificantly, from  $4.6 \pm 2.4$  to  $5.3 \pm 2.90$ . ANOVA indicated there was a significant difference in the overall fruit and vegetable knowledge score between the control and treatment group two months after the intervention, indicating the students in the treatment group retained the knowledge learned in the fruit and vegetable curriculum.

All of the students correctly answered the question “Fruit is a good source of many vitamins and minerals” at both the pretest and posttest periods. On the post-assessment, six of the ten questions were answered correctly by 82 percent or more of the students. Of the four questions that were answered incorrectly by five or more of the students on the posttest, two related to dietary fiber, one related to the nutritional value of vegetables that are cooked in a microwave oven, and one related to the availability of “fresh” fruits. These concepts (e.g., fiber, seasonality, retention of vitamins when microwaving food) should be emphasized when the curriculum is implemented.

Pirouznia (2001) reported the overall mean score on the knowledge portion of the CANKAP (Comprehensive Assessment of Nutrition Knowledge, Attitudes, and Practices) questionnaire completed by sixth-grade students was 13.7 out of a possible score of 20 points (68% correct), 11.8 out of a possible score of 25 points (47% correct) for seventh graders, and 11.5 out of a possible score of 25 points (46% correct) for eighth grade students. The high school students in the present study scored slightly higher on the pretest (52% and 55% for the treatment and control groups, respectively) than the middle school students in the CANKAP study. Pirouznia (2001) suggested corrective

measures, such as implementing nutrition education programs in elementary schools, as eating habits are more likely to be shaped in younger ages, and organizing programs and activities in science and health classes to motivate students to learn about nutrition are indicated. The low score of the pretest in the present study (52% treatment group; 55% control group) support the suggestion of Pirouznia (2001).

Upon completion of the “Fit Kids ‘r’ Healthy Kids” nutrition knowledge survey, students from the intervention group demonstrated an 8.3 percent improvement, while the control group showed only a 0.1 percent increase (Gower et al., 2010). The results of the present study also indicated an increase in nutrition knowledge in the treatment group (from 53% correct at pretest to 78% at posttest) and no change in knowledge in the control group (from 55% at pretest to 46% correct at posttest). It should be noted that the small number of questions in the present study results in large swings in the survey’s percent correct.

Jan et al. (2009) reported higher levels of knowledge in the children after exposure to the *Shape It Up* program. For the knowledge questions, the mean number of correctly answered questions rose from 3.6 at baseline to 5.0 after exposure to the intervention. After the number of questions answered correctly was converted to a percent scale, the mean score increased from 59.4 at baseline to 82.6 at the completion of the program. These results are similar to the results obtained in the present study. The authors concluded that *Shape It Up* appeared to have had a positive impact on the childrens’ knowledge and attitudes toward exercise and healthy eating. The author cautioned that additional research employing a comparison group is needed to assess the program’s impact. The present study employed a control group as suggested by Jan et al

(2009), which provides evidence that the curriculum implemented in this study was responsible for the statistically significant improvement seen in the students' knowledge compared to the control group.

## **RQ #2: Attitudes Toward Fruits and Vegetables**

The students were asked a series of questions that asked “How true are these statements for you?” on the pretest and posttest to measure their attitude toward fruits and vegetables. Wilcoxon Signed Ranks Test indicated no statistical change in response to any of the six questions in the treatment group after completion of the five-day intervention.

Heim et al. (2009) reported nearly all of the children (97.8%) enjoyed taste-testing different fruits and vegetables during their intervention. The children also reported they liked to prepare fruit and vegetable snacks (93.4%). At baseline, more than two thirds of the children had tried at least 75 percent of the 16 fruits and vegetables. At follow-up, children reported a significant increase in the number of fruits and vegetables ever eaten. The results of the present study support the results observed by Heim et al (2009) as the students tried several new fruits and vegetables.

Gentile et al. (2009) examined the immediate and short-term, sustained effects of the Switch program. Only 17 percent of the children met the recommended guidelines of fruit and vegetable consumption. There were significant increases in parent-reported fruit and vegetable consumption at post-intervention and six months post-intervention. The increase for child-reported consumption was marginally significant at post-intervention and was significant at six months post-intervention. Almost half of children and parents

reported that children ate more fruits and vegetables since beginning the program. The perception of change among the experimental group was generally positive with 23 percent to 62 percent, indicating positive changes in behavior. The present study did not query the parents to identify if they perceived their sons or daughters were consuming additional fruits and vegetables. Results of the present study did not indicate a significant increase in fruit and vegetable consumption at the end of the intervention or nine weeks after the intervention was complete.

DeVault et al. (2009) found that children in both groups had increased Food Choice Intention scores from pre- to posttest with intervention students' behavioral intent scale scores for Food Choice Intentions improving significantly at posttest versus comparison students' scores. The present study did not measure students' behavioral intent. Future researchers should consider including this concept in their pre and post-assessment instruments.

During the 2004-05 school year, the Mississippi Department of Education Child Nutrition Program initiated the Mississippi Fresh Fruit and Vegetable Pilot Program. Of the grades participating, program evaluation data indicated only eighth grade students had significant increases in positive attitudes toward eating fruit and vegetables, in their beliefs that they could eat more fruit, and in their willingness to try new fruit. Degree of preference for fruit increased significantly among eighth grade and tenth grade students, but decreased significantly among fifth grade students. Intention to eat fruit increased significantly among tenth grade students, but not among fifth and eighth grade students (CDC, 2006).

### **RQ #3: Consumption of Fruits and Vegetables**

The third research question examined the impact of the five-day nutrition education unit on the students' self-reported consumption of fruits and vegetables at the completion of the unit. The treatment group in the present study was comprised of a mix of males (n=13) and females (n=9). Analysis of the data indicated no statistically significant difference between the control and treatment group, either before or after the intervention.

Perry et al. (1998) found that there was a significant and favorable intervention effect among girls for vegetable consumption at lunch, but not among boys. Pirouznia (2001) found there was a significant difference between the eating behavior scores of seventh and eighth-grade boys and girls. There was no correlation between nutrition knowledge and food choices for sixth-grade male or female students or for boys in the seventh and eighth grades. Caine-Bish & Scheule (2009) reported that boys demonstrated a higher preference for ethnic foods, fish and casseroles, and beef, pork, and barbeque than girls. Conversely, the starches and sweets factor was significantly more preferred by the girls than the boys. Girls also showed a higher preference for fruits and vegetables than boys.

#### *Recommended Cups of Fruit and Vegetables per Day*

At the pretest, students in the treatment group (n=22) indicated they thought they should eat  $2.3 \pm 1.0$  cups of fruit per day, while the control group (n=19) reported they thought they should be eating  $2.8 \pm 0.8$  cups of fruit per day. There was no difference between the groups at the pretest. At the posttest, students in the treatment group

reported they should eat  $2.1 \pm 0.8$  cups of fruit per day, while the control thought they should be eating  $2.7 \pm 0.8$  cups of fruit per day. There was no difference between the groups at the posttest. It should be noted, however, that the change in the treatment group was in the right direction, getting closer to the 2 cups of fruit per day recommended in MyPyramid and emphasized in the five-day nutrition curriculum.

At the pretest, students in the treatment group thought they should eat  $2.1 \pm 1.0$  cups of vegetables per day, while the control group thought they should eat  $2.7 \pm 0.7$  cups of vegetables per day. These results are not statistically different between groups at the pretest. At the posttest students in the treatment group thought they should eat  $2.2 \pm 0.8$  cups of vegetables per day, while the control group thought they should be eating  $2.4 \pm 0.9$  cups of vegetables per day. Results indicated no statistical difference between the groups at posttest. It should be noted, however, that the change in the treatment group (e.g., increasing from  $2.1 \pm 1.0$  to  $2.2 \pm 0.8$ ) moved in the right direction and with a smaller standard deviation, getting closer to the 2.5 cups of vegetables per day recommended in MyPyramid and emphasized in the five-day nutrition curriculum.

#### *Fruits and Vegetables Consumed per Day*

At the pretest, students in the treatment group reported they usually ate  $1.4 \pm 0.9$  cups of fruit per day, while the control group reported they usually ate  $2.3 \pm 2.6$  cups of fruit per day. There was no difference between the treatment group and the control group at pretest. Students at the posttest, in the treatment group, reported they usually ate  $1.6 \pm 1.2$  cups of fruit per day, while the control group reported they usually ate  $2.0 \pm 1.6$  cups per day. Again, results indicated no statistical difference between groups. Although



there was a slight increase in the number of cups of fruit the treatment group reported usually consuming at posttest compared to pretest, the difference was not significant.

At the pretest, students in the treatment group reported they usually ate  $1.4 \pm 1.3$  cups of vegetables per day, while the control group usually ate  $2.0 \pm 1.8$  cups per day. There was no statistical difference between the groups at pretest. At the posttest, students in the treatment group reported they usually ate  $1.6 \pm 1.3$  cups of vegetables per day while the control group reported usually eating  $1.7 \pm 1.2$  cups of vegetables per day. There was no statistical difference between the treatment group and control group at the posttest. Although there was a slight increase in the number of cups of vegetables the treatment group reported usually consuming at posttest compared to the pretest, the difference was not significant.

When the self-reported number of servings of fruits ( $1.6 \pm 1.2$  cups) and vegetables ( $1.6 \pm 1.3$  cups) consumed by the treatment group were added together, the resultant 3.2 cups daily are 1.3 cups short of current recommendations for a 2000 calorie diet. When the number of servings of fruits ( $2.0 \pm 1.6$  cups) and vegetables ( $1.7 \pm 1.2$  cups) consumed by the control group were added together, the resultant 3.7 cups daily are slightly less than one serving short of current recommendations for a 2000 calorie diet. The results of the present study do indicate, however, that at post-assessment (3.2 cups), the treatment group increased their consumption of fruits and vegetables by 0.4 cups over their pretest (2.8 cups). In contrast, the control group reported a reduction in total fruit and vegetable consumption from 4.3 cups (pre-assessment) to 3.7 cups (post-assessment).

Kimmons et al. (2009) noted that few American adolescents or adults reported consuming the recommended amounts of fruits or vegetables. Adolescents consumed

more juice and less whole fruits than adults. Both adolescents and adults consumed higher median quantities of vegetables than fruits, although the median vegetable intake among adolescents was much less when fried potatoes were not included. The percentage meeting recommendations for vegetable subtypes was lowest for dark green vegetables, orange vegetables, and legumes but higher for starchy and other vegetables. The results of the present study support the findings of Kimmons et al. (2009).

Krebs-Smith et al. (1996) found that young children of both sexes consumed about one serving of fruit per day, although this tapered off to about a half serving for those in their teenage years. Only one in five children consumed five or more servings of fruits and vegetables per day. The students in the present study exceeded the fruit and vegetable consumption observed by Krebs-Smith et al. (1996).

Casagrande et al. (2007) found that approximately 62 percent of adults did not consume any whole fruit servings, 75 percent did not consume any fruit juice servings, and approximately 25 percent of participants reported eating no daily vegetable servings. Eleven percent of participants met USDA guidelines in fruit and vegetables servings. Krebs-Smith et al. (1996) found that French-fried potatoes alone constituted about 23 percent of all vegetables consumed. Davis et al. (2009) reported almost 60 percent of the students in their intervention group reported eating at least one fruit per day, compared with only approximately 41 percent for the comparison school students. Results of the present study indicated the high school students in Carothersville Junior/Senior High School eat more fruits and vegetables than reported by Davis et al. (2009).

Among the eighth grade and tenth grade student who participated in the dietary recall interviews on the Mississippi Fresh Fruit and Vegetable Pilot Program (CDC,

2006), student consumption of fruit in school and overall increased significantly by 0.34 and 0.61 servings per day, respectively. The results of the present study indicated an increase of 0.4 cups of fruits and vegetables per day after completion of the five-day curriculum, similar to that seen by the Mississippi students.

### *Choose Fruits or Vegetables as a Snack*

At the pretest, there was no difference between the control group and the treatment group in response to the question “how often would you choose fruit as a snack instead of chips or candy?,” with the majority of the students responding “I would sometimes,” and approximately one-quarter of the students indicated they would choose fruit as a snack “most of the time.” There was no change, from pretest to posttest, in the percent of students who reported they would choose fruit as a snack instead of chips or candy in either the treatment or the control groups.

At the pretest, there was no difference between the control group and the treatment group in response to the question “How often would you choose vegetables as a snack instead of chips or candy?” The majority of the students answered “I would sometime.” There was no change, from pretest to posttest, in the percent of students who reported they would choose fruit as a snack instead of chips or candy in either the treatment or control groups.

No comparative studies that examined the selection of fruits or vegetables in place of candy or chips were identified in the literature. Future researchers are encouraged to include this question as they assess the role of fruits and vegetables in the diets of adolescents.

*Select New Fruit or Vegetable if Offered*

On the pretest, 41 percent of the students in the treatment group, and 37 percent of the students in the control group, reported they would try a new fruit if it was served with the school lunch. On the posttest, the percent who responded “yes” from the treatment group increased significantly from 41 percent to 68 percent, while the percent for the students in the control group remained the same.

On the pretest, the majority of the students in the control group and the treatment group reported they would “maybe” try a new vegetable if it was served with their lunch. There was no statistical difference in the distribution at baseline or at posttest.

Similarly, no comparative studies that examined the selection of a new fruit or vegetable if it was offered with the school lunch were identified in the literature. Future researchers are encouraged to include this question as they assess the role of fruits and vegetables in the diets of adolescents, particularly in light of the newly proposed USDA guidelines for school lunches that, at present (<http://www.fns.usda.gov/cnd/>), limit starchy vegetables (e.g., potatoes) and include a greater emphasis on the inclusion of non-starchy vegetables and fresh fruit.

*Tried a New Fruit or Vegetable Lately*

On the pretest, 27.3 percent of the treatment group and 15.8 percent of the control group indicated they had tried a new fruit lately, while on the posttest, only 22.7 percent of the treatment group, and 15.8 percent of the control group indicated they had tried a new fruit lately. The results indicated there was no statistical difference.

On the pretest, 13.6 percent of the treatment group, and 15.8 percent of the control group indicated they had tried a new vegetable lately, while on the posttest, the percent of students that had tried a new vegetable recently had increased to 22.7 percent in the treatment group, but remained the same in the control group. Results show there was no statistical difference at pretest or posttest.

Approximately 27 percent of the students in the study by Davis et al. (2009) reported trying a new fruit, but only five percent reported trying a new vegetable. Davis et al. (2009) suggests future fresh fruit and vegetable programs could coordinate with school foodservice so that the National School Lunch Program includes new vegetables to increase students' exposure and preference. Despite not being statistically significant, results of the present study indicate more students in the treatment (22.7%) had tried a new vegetable at the post-assessment, providing modest evidence that the curriculum aided the consumption of vegetables among participants.

#### *Eat School Lunch Fruits and Vegetables*

On the pretest, the majority of the students in both the control group and the treatment groups indicated they ate the fruit that was offered with the school lunch either "never" or only "1-2 days per week." On the posttest, the number of students in the treatment group who indicated they ate the fruit offered with the lunch either "never" or only "1-2 days per week" increased from 68 percent to 77 percent. There was no statistical difference between the groups at pretest or posttest.

On the pretest, the majority of the students in both the control and treatment groups indicated they ate the vegetables that were offered with the school lunch either

“never” or only “1-2 days per week.” On the posttest, the number of students in the treatment group who indicated they ate the vegetables offered with the school lunch either “never” or only “1-2 days per week” decreased by one student, from 77 percent to 73 percent. Results show there was no statistical difference between groups at the pretest or posttest.

Perry et al. (1998) conducted a randomized school-based trial to increase fruit and vegetable consumption among children. Lunchroom observations and 24-hour food recalls were used to measure food consumption. Results showed there was an increased lunchtime fruit consumption and combined fruit and vegetable consumption, lunchtime vegetable consumption among girls, and daily fruit consumption. The results of the present study do not support the observation of Perry et al. (1998), perhaps because of the small sample size in the present study.

#### *Pack a Fruit or Vegetable at Lunch*

On the pretest, the majority of the students in the treatment group indicated they packed a fruit with the lunch either every day, 3-4 days per week, or 1-2 days per week. A similar distribution was seen in the control group. One quarter of the students in the treatment group and almost half of the students in the control group indicated they never pack a fruit with their lunch.

The data shows, on the posttest, the majority of the students in the treatment group indicated they pack a fruit with their lunch every day, 3-4 days per week or 1-2 days per week, as well. A similar distribution was seen in the control group on the posttest. Twenty-seven percent of the students in the treatment group and 21 percent of

the students in the control group indicated they never pack a fruit with their lunch. There was no statistical difference between the groups at the posttest or the pretest.

On the pretest and posttest, slightly more than half of the students in the treatment group indicated they pack a vegetable with their lunch every day, 3-4 days per week, or 1-2 days per week. A similar distribution was seen in the control group on the pretest and the posttest. On the pretest and posttest, 41 percent of the students in the treatment group, and 32 percent of the students in the control group indicated they never pack a vegetable with their lunch. There was no statistical difference between the groups at pretest or posttest.

Hastert & Babey (2009) found that adolescents who typically brought their lunch to school from home five days per week consumed fast food fewer times and consumed fewer servings of soda, fried potatoes and high-sugar foods, and more fruit and vegetables compared with adolescents who never brought their lunch to school. Students who typically brought their lunch to school between 1 and 4 days per week also consumed fast food significantly fewer times and consumed fewer daily servings of soda and more daily servings of fruit and vegetables compared with students who never brought their lunch to school. Results of the present study do support the results of Hastert & Babey (2009), but it should be noted that the present study did not assess fast food consumption or the consumption of soda and French fries.

## **Summary**

The results of this study demonstrate a statistically significant increase in knowledge about fruits and vegetables at the end of the five-day intervention, with a

retention of the knowledge in the treatment group two months after the intervention. The results do not support a statistically significant relationship between a five-day intervention and the subjects' attitude toward and consumption of fruits and vegetables. The results of this study leave the researcher with more questions than answers regarding the relationship between the intervention and the attitudes toward and consumption of fruits and vegetables. This researcher suggests that the intervention might be too late to help change behaviors in high school students, and therefore should be implemented in elementary schools. At a minimum, the intervention should be implemented among a larger sample using more than ten knowledge questions.



## CHAPTER 6

### CONCLUSION, LIMITATIONS AND RECOMMENDATIONS

The purpose of this quasi-experimental study was to determine the impact of five 50-minute nutrition lessons and cooking demonstrations/labs developed by this researcher on high school students' knowledge, attitude, and food consumption behavior of fruits and vegetables. This chapter will summarize the results of the study, state the limitations of the study, and provide recommendations for future research.

#### **Conclusion**

Youth Behavior Risk Factor Surveillance System data (YRBSS) indicate teenagers do not consume the recommended number of servings of fruits and vegetables (CDC, 2010b). Establishing healthy eating habits at a young age can influence habits for a lifetime. Thus, identifying ways to encourage the consumption of fruits and vegetables by teenagers was warranted.

Results of this study indicated a five-day nutrition education unit that emphasized basic knowledge and hands-on preparation and consumption of various fruits and vegetables was successful in improving students' knowledge of fruits and vegetables. Unfortunately, in this small group of subjects (n=22), the curriculum demonstrated

limited success in statistically influencing students' attitudes and consumption behaviors, both upon completion of the unit and two months later. Increasing the sample size may have resulted in enough subjects to increase the power to detect statistical differences, both between groups (control and treatment) and within the treatment group. Researchers are encouraged to continue to identify acceptable ways to increase students' consumption of fruits and vegetables.

### **Limitations**

The results of this study were limited by the following factors that constrain the generalizability and utility of the findings:

1. A small, homogenous sample size (19 in the control group and 22 in the experimental group) was used;
2. A convenience sample comprised of one foods class (experimental) and one family relations class (control group), rather than a random sample, was used;
3. The results were measured over a short period of time, perhaps not allowing adequate time for behavior change to occur;
4. No other external factors that could influence a student's fruit and vegetable intake (e.g., type of fruits and vegetables served in the cafeteria during the intervention week; weather; income) were measured;
5. The fifty-minute time period limited the laboratory experiences for the students, thus limiting the variety of fruits and vegetables they were able to try; and

6. Budgetary constraints, time of year when the curriculum was implemented (January), and higher prices in this small, rural community limited the quantity of fruits and vegetables that were offered to the students.

### **Recommendations for Future Research**

The researcher makes the following recommendations:

- 1) The curriculum should be re-tested with:
  - a) a larger population;
  - b) a younger population (e.g., middle school students rather than high school students); and
  - c) a more diverse population (e.g., rural vs. urban, race/ethnicity)
- 2) The curriculum should be enhanced to include:
  - a) additional hands-on recipes appropriate for middle-school students, especially those that emphasize fruits and vegetables not commonly consumed; and
  - b) a greater emphasis on the number of servings for fruits and vegetables needed daily based on the Food Guide Pyramid.
- 3) The instruments used to assess knowledge, attitudes, and behavior needs to be re-examined to:
  - a) increase the reliability of the exam;
  - b) measure behavioral intent of both students and parents;
  - c) reduce the options in an effort to make the statistical analysis less complex;
  - d) ensure the questions are adequately emphasized in the curriculum; and
  - e) include more nutrition knowledge questions.

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## APPENDIX A

### Institutional Review Board Documents

- A-1 Letter of Approval from BSU IRB
- A-2 CITI Certificate of Completion

## A-1 Letter of Approval from BSU IRB



## Institutional Review Board

DATE: September 24, 2010

TO: Monica Durham

FROM: Ball State University IRB

RE: IRB protocol # 186554-2

TITLE: Impact of an Education Strategy to Increase Nutrition Knowledge, Attitudes, and Consumption Patterns of Fruits and Vegetables Among High School Students in a Rural Midwestern Community

SUBMISSION TYPE: Revision

ACTION: APPROVED

DECISION DATE: September 24, 2010

EXPIRATION DATE: September 23, 2011

REVIEW TYPE: Expedited Review

---

The Institutional Review Board has approved your Revision for the above protocol, effective September 24, 2010 through September 23, 2011. All research under this protocol must be conducted in accordance with the approved submission.

**As a reminder, it is the responsibility of the P.I. and/or faculty sponsor to inform the IRB in a timely manner:**

- when the project is completed,
- if the project is to be continued beyond the approved end date,
- if the project is to be modified,
- if the project encounters problems, or
- if the project is discontinued.

Any of the above notifications should be addressed in writing and submitted electronically to the IRB (<http://www.bsu.edu/irb>). Please reference the IRB protocol number given above in any communication to the IRB regarding this project. Be sure to allow sufficient time for review and approval of requests for modification or continuation. If you have questions, please contact Chris Mangelli at (765) 285-5070 or [cmmangelli@bsu.edu](mailto:cmmangelli@bsu.edu).

## A-2 CITI Certificate of Completion

**Social & Behavioral Research - Basic/Refresher Curriculum Completion Report**  
**Printed on 8/16/2010**

**Learner:** Monica Durham

**Institution:** Ball State University

**Social & Behavioral Research - Basic/Refresher:** Choose this group to satisfy CITI training requirements for Investigators and staff involved primarily in Social/Behavioral Research with human subjects.

**Stage 1. Basic Course Passed on 05/03/10 (Ref # 4374245)**

Required Modules	Date Completed	Score
Belmont Report and CITI Course Introduction	05/01/10	3/3 (100%)
Students in Research - SBR	05/01/10	10/10 (100%)
History and Ethical Principles - SBR	05/03/10	4/4 (100%)
Defining Research with Human Subjects - SBR	05/03/10	5/5 (100%)
The Regulations and The Social and Behavioral Sciences - SBR	05/03/10	5/5 (100%)
Assessing Risk in Social and Behavioral Sciences - SBR	05/03/10	5/5 (100%)
Informed Consent - SBR	05/03/10	5/5 (100%)
Privacy and Confidentiality - SBR	05/03/10	2/3 (67%)
Research with Prisoners - SBR	05/03/10	4/4 (100%)
Research with Children - SBR	05/03/10	4/4 (100%)
Research in Public Elementary and Secondary Schools - SBR	05/03/10	4/4 (100%)
International Research - SBR	05/03/10	3/3 (100%)
Internet Research - SBR	05/03/10	4/4 (100%)
HIPAA and Human Subjects Research	05/03/10	2/2 (100%)
Workers as Research Subjects-A Vulnerable Population	05/03/10	4/4 (100%)
Conflicts of Interest in Research Involving Human Subjects	05/03/10	2/2 (100%)
Ball State University	05/03/10	no quiz

**For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.**

Paul Braunschweiger Ph.D., Professor, University of Miami;  
 Director Office of Research Education, CITI Course Coordinator

## APPENDIX B

### Fruit and Vegetable Student Survey

- B-1 Pre-Test Survey
- B-2 Post-Test Survey
- B-3 Follow-Up Survey

# Fruit and Vegetable Student Survey

## Pre-Assessment



Name: \_\_\_\_\_

School ID#: \_\_\_\_\_

Birth Date: \_\_\_\_\_

# **Fruit and Vegetable Student Survey**



## High School Student Survey

- This survey asks about you and what you think about eating different foods.
- No one but you will know how you answer these questions.
- Please read each question carefully.
- Use a ✓ or an X to mark the answer that is best for you.
- Please mark only one answer for each question.
- Raise your hand to ask for help if you have questions.

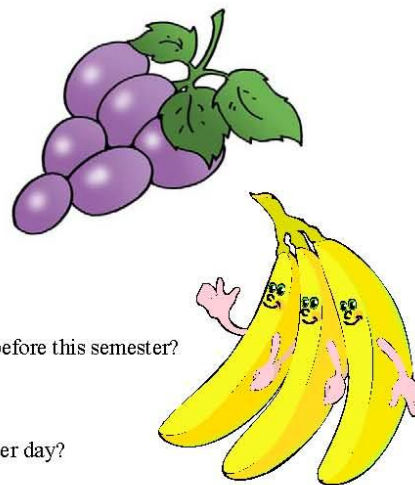
Thank you for taking this survey!

ID#: \_\_\_\_\_

## High School Survey – Pre Assessment

### Questions About You...

1. Gender:
  - ☐ Male
  - ☐ Female
2. Age: \_\_\_\_\_
3. Grade:
  - ☐ Freshman
  - ☐ Sophomore
  - ☐ Junior
  - ☐ Senior
4. Have you ever taken a food/nutrition course in high school before this semester?
  - ☐ Yes
  - ☐ No
5. About how many cups of fruit do you think you should eat per day?
  - ☐ ½-1 cup
  - ☐ 2-2 ½ cups
  - ☐ 3-4 cups
  - ☐ 5 or more cups
6. About how many cups of vegetables do you think you should eat per day?
  - ☐ ½-1 cup
  - ☐ 2-2 ½ cups
  - ☐ 3-4 cups
  - ☐ 5 or more cups
7. About how many cups of **fruit** do you usually eat per day? \_\_\_\_\_ cups
8. About how many cups of **vegetables** do you usually eat per day? \_\_\_\_\_ cups



### Questions About Different Foods You Might Eat. Mark ONE answer per question.

1. How often would you choose **fruit** as a snack instead of chips or candy?
  - ☐ I never would
  - ☐ I rarely would
  - ☐ I would sometimes
  - ☐ I would most of the time
2. How often would you choose **vegetables** as a snack instead of chips or candy?
  - ☐ I never would
  - ☐ I rarely would
  - ☐ I would sometimes
  - ☐ I would most of the time



### How Would You Feel....

3. If a new **fruit** was served with your lunch today, would you try it?  
☐ Yes  
☐ Maybe  
☐ No
4. If a new **vegetable** was served with your lunch today, would you try it?  
☐ Yes  
☐ Maybe  
☐ No



### How True Are These Statements For You?

5. I am afraid to eat a **fruit** I have never had before.  
☐ Not true at all    ☐ Not really    ☐ Sort of true    ☐ Absolutely
6. I am very picky about the **fruit** I eat.  
☐ Not true at all    ☐ Not really    ☐ Sort of true    ☐ Absolutely
7. I will eat almost any **fruit**.  
☐ Absolutely    ☐ Sort of true    ☐ Not really    ☐ Not true at all
8. I am afraid to eat a **vegetable** I have never had before.  
☐ Not true at all    ☐ Not really    ☐ Sort of true    ☐ Absolutely
9. I am very picky about the **vegetables** I will eat.  
☐ Not true at all    ☐ Not really    ☐ Sort of true    ☐ Absolutely
10. I will eat almost any vegetable.  
☐ Absolutely    ☐ Sort of true    ☐ Not really    ☐ Not true at all
11. I have tried a new fruit recently.  
☐ No    ☐ Yes, I tried: \_\_\_\_\_ (please name the fruit)
12. I have tried a new vegetable recently.  
☐ No    ☐ Yes, I tried: \_\_\_\_\_ (please name the vegetable)

### What Do You Think?

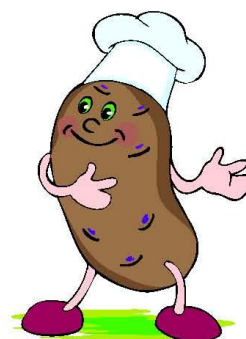
13. How often do you usually buy school lunch during a school week?  
☐ Never    ☐ 1-2 days/wk    ☐ 3-4 days/wk    ☐ Every day
14. If you buy the school lunch, how often do you eat the **fruit** offered?  
☐ Never    ☐ 1-2 days/wk    ☐ 3-4 days/wk    ☐ Every day
15. If you buy the school lunch, how often do you eat the **vegetable** offered?  
☐ Never    ☐ 1-2 days/wk    ☐ 3-4 days/wk    ☐ Every day
16. If you pack your school lunch, how often do you pack a fruit?  
☐ Never    ☐ 1-2 days/wk    ☐ 3-4 days/wk    ☐ Every day
17. If you pack your lunch, how often do you pack a vegetable?  
☐ Never    ☐ 1-2 days/wk    ☐ 3-4 days/wk    ☐ Every day

### Circle The Answer You Think Is Correct

1. True      False      Fruits are only available **fresh** during the time of the year they are "in season."
2. True      False      Fruit is a good source of many vitamins and fiber.
3. True      False      Most vegetables are low in calories.
4. True      False      Vegetables cooked in a microwave oven are *less nutritious* than vegetables cooked in water on the stove.

### Put An "X" In The Answer You Think Is Correct

5. Which of these fruits is a good source of vitamin A?
  - ☐ apples
  - ☐ cherries
  - ☐ peaches
  - ☐ pears
6. Based on a 2000 calorie diet, how many cups of fruits and vegetable **combined** do you think you need to eat every day?
  - ☐ 2 cups
  - ☐ 4 ½ cups
  - ☐ 5 cups
  - ☐ 6 ½ cups
7. Vegetable skin and pulp provide \_\_\_\_\_ to aid in digestion and help keep you 'regular'.
  - ☐ Vitamins
  - ☐ Minerals
  - ☐ Nutrients
  - ☐ Fiber
8. Some nutrients in vegetables are \_\_\_\_\_ - \_\_\_\_\_ and will dissolve in the cooking liquid.
  - ☐ Heat-soluble
  - ☐ Water-soluble
  - ☐ Heat-sensitive
  - ☐ Fat-soluble
9. \_\_\_\_\_ are an excellent source of vitamin C.
  - ☐ Potatoes
  - ☐ Green beans
  - ☐ Oranges
  - ☐ Watermelons
10. About how many grams of fiber are recommended every day?
  - ☐ 15-25 grams
  - ☐ 20-35 grams
  - ☐ 10-20 grams
  - ☐ 30-45 grams



### How Do You Feel About Eating These Fruits And Vegetables?

	Like a Lot	It's OK	Don't Like	Hate It!	Never Tried
Pear	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kiwi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pineapple	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peach	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tangerine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Like a Lot	It's OK	Don't Like	Hate It!	Never Tried
Broccoli	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cauliflower	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Zucchini	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
French Fries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sweet Red Pepper	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Usual Fruit and Vegetable Intake

How often do you eat or drink each of the following foods? For example, if you drink fruit juice twice a week, write "2" before "per week." Include all foods you eat or drink, both at home and away from home.

- How often do you drink fruit juices such as orange, grapefruit, or tomato?  
☐ Per day ☐ I never drink fruit juice  
☐ Per week  
☐ Per month
- Not counting juice, how often do you eat fruit?  
☐ Per day ☐ I never eat fruit  
☐ Per week  
☐ Per month
- How often do you eat green salad?  
☐ Per day ☐ I never eat green salad  
☐ Per week  
☐ Per month
- How often do you eat potatoes not including French fries, fried potatoes, or potato chips?  
☐ Per day ☐ I never eat potatoes that aren't fried  
☐ Per week  
☐ Per month
- How often do you eat carrots?  
☐ Per day ☐ I never eat carrots  
☐ Per week  
☐ Per month
- Not counting carrots, potatoes, or salad, how many servings of vegetables do you usually eat?  
 (Example: A serving of vegetables at both lunch and dinner would be two servings per day.)  
☐ Per day ☐ I never eat other vegetables  
☐ Per week  
☐ Per month



## B-2 Post-Test Survey

# Fruit and Vegetable Student Survey

Post-Assessment



Name: \_\_\_\_\_

School ID#: \_\_\_\_\_

Birth Date: \_\_\_\_\_

# **Fruit and Vegetable Student Survey**



## High School Student Survey

- This survey asks about you and what you think about eating different foods.
- No one but you will know how you answer these questions.
- Please read each question carefully.
- Use a ✓ or an X to mark the answer that is best for you.
- Please mark only one answer for each question.
- Raise your hand to ask for help if you have questions.

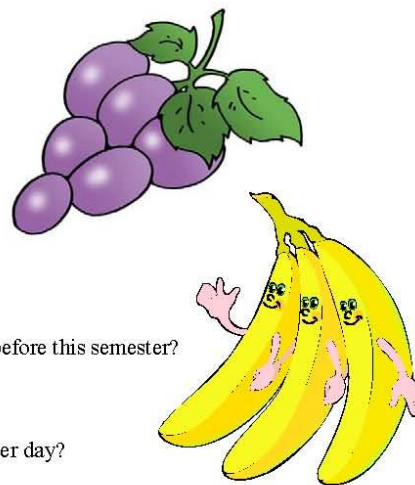
Thank you for taking this survey!

ID#: \_\_\_\_\_

## High School Survey – Post Assessment

### Questions About You...

1. Gender:
  - ☐ Male
  - ☐ Female
2. Age: \_\_\_\_\_
3. Grade:
  - ☐ Freshman
  - ☐ Sophomore
  - ☐ Junior
  - ☐ Senior
4. Have you ever taken a food/nutrition course in high school before this semester?
  - ☐ Yes
  - ☐ No
5. About how many cups of fruit do you think you should eat per day?
  - ☐ ½-1 cup
  - ☐ 2-2 ½ cups
  - ☐ 3-4 cups
  - ☐ 5 or more cups
6. About how many cups of vegetables do you think you should eat per day?
  - ☐ ½-1 cup
  - ☐ 2-2 ½ cups
  - ☐ 3-4 cups
  - ☐ 5 or more cups
7. About how many cups of **fruit** do you usually eat per day? \_\_\_\_\_ cups
8. About how many cups of **vegetables** do you usually eat per day? \_\_\_\_\_ cups



### Questions About Different Foods You Might Eat. Mark ONE answer per question.

1. How often would you choose **fruit** as a snack instead of chips or candy?
  - ☐ I never would
  - ☐ I rarely would
  - ☐ I would sometimes
  - ☐ I would most of the time
2. How often would you choose **vegetables** as a snack instead of chips or candy?
  - ☐ I never would
  - ☐ I rarely would
  - ☐ I would sometimes
  - ☐ I would most of the time

### How Would You Feel....

3. If a new **fruit** was served with your lunch today, would you try it?  
☐ Yes  
☐ Maybe  
☐ No
4. If a new **vegetable** was served with your lunch today, would you try it?  
☐ Yes  
☐ Maybe  
☐ No



### How True Are These Statements For You?

5. I am afraid to eat a **fruit** I have never had before.  
☐ Not true at all    ☐ Not really    ☐ Sort of true    ☐ Absolutely
6. I am very picky about the **fruit** I eat.  
☐ Not true at all    ☐ Not really    ☐ Sort of true    ☐ Absolutely
7. I will eat almost any **fruit**.  
☐ Absolutely    ☐ Sort of true    ☐ Not really    ☐ Not true at all
8. I am afraid to eat a **vegetable** I have never had before.  
☐ Not true at all    ☐ Not really    ☐ Sort of true    ☐ Absolutely
9. I am very picky about the **vegetables** I will eat.  
☐ Not true at all    ☐ Not really    ☐ Sort of true    ☐ Absolutely
10. I will eat almost any vegetable.  
☐ Absolutely    ☐ Sort of true    ☐ Not really    ☐ Not true at all
11. I have tried a new fruit recently.  
☐ No    ☐ Yes, I tried: \_\_\_\_\_ (please name the fruit)
12. I have tried a new vegetable recently.  
☐ No    ☐ Yes, I tried: \_\_\_\_\_ (please name the vegetable)

### What Do You Think?

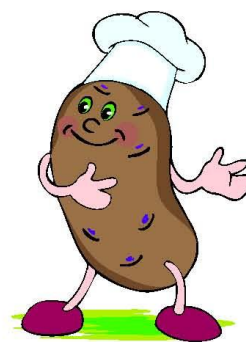
13. How often do you usually buy school lunch during a school week?  
☐ Never    ☐ 1-2 days/wk    ☐ 3-4 days/wk    ☐ Every day
14. If you buy the school lunch, how often do you eat the **fruit** offered?  
☐ Never    ☐ 1-2 days/wk    ☐ 3-4 days/wk    ☐ Every day
15. If you buy the school lunch, how often do you eat the **vegetable** offered?  
☐ Never    ☐ 1-2 days/wk    ☐ 3-4 days/wk    ☐ Every day
16. If you pack your school lunch, how often do you pack a fruit?  
☐ Never    ☐ 1-2 days/wk    ☐ 3-4 days/wk    ☐ Every day
17. If you pack your lunch, how often do you pack a vegetable?  
☐ Never    ☐ 1-2 days/wk    ☐ 3-4 days/wk    ☐ Every day

**Circle The Answer You Think Is Correct**

1. True      False      Fruits are only available **fresh** during the time of the year they are “in season.”
2. True      False      Fruit is a good source of many vitamins and fiber.
3. True      False      Most vegetables are low in calories.
4. True      False      Vegetables cooked in a microwave oven are *less nutritious* than vegetables cooked in water on the stove.

**Put An “X” In The Answer You Think Is Correct**

5. Which of these fruits is a good source of vitamin A?
  - ☐ apples
  - ☐ cherries
  - ☐ peaches
  - ☐ pears
6. Based on a 2000 calorie diet, how many cups of fruits and vegetable **combined** do you think you need to eat every day?
  - ☐ 2 cups
  - ☐ 4 ½ cups
  - ☐ 5 cups
  - ☐ 6 ½ cups
7. Vegetable skin and pulp provide \_\_\_\_\_ to aid in digestion and help keep you ‘regular’.
  - ☐ Vitamins
  - ☐ Minerals
  - ☐ Nutrients
  - ☐ Fiber
8. Some nutrients in vegetables are \_\_\_\_\_ - \_\_\_\_\_ and will dissolve in the cooking liquid.
  - ☐ Heat-soluble
  - ☐ Water-soluble
  - ☐ Heat-sensitive
  - ☐ Fat-soluble
9. \_\_\_\_\_ are an excellent source of vitamin C.
  - ☐ Potatoes
  - ☐ Green beans
  - ☐ Oranges
  - ☐ Watermelons
10. About how many grams of fiber are recommended every day?
  - ☐ 15-25 grams
  - ☐ 20-35 grams
  - ☐ 10-20 grams
  - ☐ 30-45 grams





### How Do You Feel About Eating These Fruits And Vegetables?

	Like a Lot	It's OK	Don't Like	Hate It!	Never Tried
Pear	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kiwi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pineapple	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peach	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tangerine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Like a Lot	It's OK	Don't Like	Hate It!	Never Tried
Broccoli	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cauliflower	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Zucchini	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
French Fries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sweet Red Pepper	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Usual Fruit and Vegetable Intake

How often do you eat or drink each of the following foods? For example, if you drink fruit juice twice a week, write "2" before "per week." Include all foods you eat or drink, both at home and away from home.

1. How often do you drink fruit juices such as orange, grapefruit, or tomato?

☐ Per day  
☐ Per week  
☐ Per month

☐ I never drink fruit juice

2. Not counting juice, how often do you eat fruit?

☐ Per day  
☐ Per week  
☐ Per month

☐ I never eat fruit

3. How often do you eat green salad?

☐ Per day  
☐ Per week  
☐ Per month

☐ I never eat green salad

4. How often do you eat potatoes not including French fries, fried potatoes, or potato chips?

☐ Per day  
☐ Per week  
☐ Per month

☐ I never eat potatoes that aren't fried

5. How often do you eat carrots?

☐ Per day  
☐ Per week  
☐ Per month

☐ I never eat carrots

6. Not counting carrots, potatoes, or salad, how many servings of vegetables do you usually eat? (Example: A serving of vegetables at both lunch and dinner would be two servings per day.)

☐ Per day  
☐ Per week  
☐ Per month

☐ I never eat other vegetables



## B-3 Follow-Up Survey

# Fruit and Vegetable Student Survey

## Follow-Up Assessment



Name: \_\_\_\_\_

School ID#: \_\_\_\_\_

Birth Date: \_\_\_\_\_

# **Fruit and Vegetable Student Survey**



## High School Student Survey

- This survey asks about you and what you think about eating different foods.
- No one but you will know how you answer these questions.
- Please read each question carefully.
- Use a ✓ or an X to mark the answer that is best for you.
- Please mark only one answer for each question.
- Raise your hand to ask for help if you have questions.

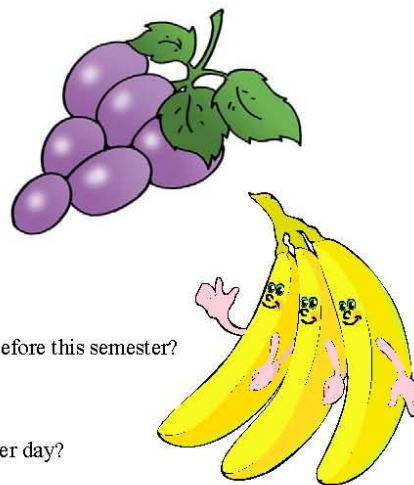
Thank you for taking this survey!

ID#: \_\_\_\_\_

## High School Survey – Follow-Up Assessment

### Questions About You...

1. Gender:
  - ☐ Male
  - ☐ Female
2. Age: \_\_\_\_\_
3. Grade:
  - ☐ Freshman
  - ☐ Sophomore
  - ☐ Junior
  - ☐ Senior
4. Have you ever taken a food/nutrition course in high school before this semester?
  - ☐ Yes
  - ☐ No
5. About how many cups of fruit do you think you should eat per day?
  - ☐ ½-1 cup
  - ☐ 2-2 ½ cups
  - ☐ 3-4 cups
  - ☐ 5 or more cups
6. About how many cups of vegetables do you think you should eat per day?
  - ☐ ½-1 cup
  - ☐ 2-2 ½ cups
  - ☐ 3-4 cups
  - ☐ 5 or more cups
7. About how many cups of **fruit** do you usually eat per day? \_\_\_\_\_ cups
8. About how many cups of **vegetables** do you usually eat per day? \_\_\_\_\_ cups



### Questions About Different Foods You Might Eat. Mark ONE answer per question.

1. How often would you choose **fruit** as a snack instead of chips or candy?
  - ☐ I never would
  - ☐ I rarely would
  - ☐ I would sometimes
  - ☐ I would most of the time
2. How often would you choose **vegetables** as a snack instead of chips or candy?
  - ☐ I never would
  - ☐ I rarely would
  - ☐ I would sometimes
  - ☐ I would most of the time

### How Would You Feel....

3. If a new **fruit** was served with your lunch today, would you try it?  
☐ Yes  
☐ Maybe  
☐ No
4. If a new **vegetable** was served with your lunch today, would you try it?  
☐ Yes  
☐ Maybe  
☐ No



### How True Are These Statements For You?

5. I am afraid to eat a **fruit** I have never had before.  
☐ Not true at all    ☐ Not really    ☐ Sort of true    ☐ Absolutely
6. I am very picky about the **fruit** I eat.  
☐ Not true at all    ☐ Not really    ☐ Sort of true    ☐ Absolutely
7. I will eat almost any **fruit**.  
☐ Absolutely    ☐ Sort of true    ☐ Not really    ☐ Not true at all
8. I am afraid to eat a **vegetable** I have never had before.  
☐ Not true at all    ☐ Not really    ☐ Sort of true    ☐ Absolutely
9. I am very picky about the **vegetables** I will eat.  
☐ Not true at all    ☐ Not really    ☐ Sort of true    ☐ Absolutely
10. I will eat almost any vegetable.  
☐ Absolutely    ☐ Sort of true    ☐ Not really    ☐ Not true at all
11. I have tried a new fruit recently.  
☐ No    ☐ Yes, I tried: \_\_\_\_\_ (please name the fruit)
12. I have tried a new vegetable recently.  
☐ No    ☐ Yes, I tried: \_\_\_\_\_ (please name the vegetable)

### What Do You Think?

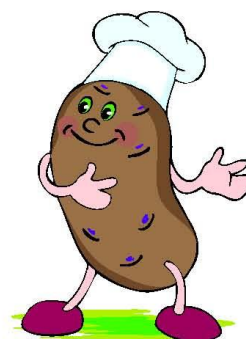
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15. If you buy the school lunch, how often do you eat the **vegetable** offered?  
☐ Never    ☐ 1-2 days/wk    ☐ 3-4 days/wk    ☐ Every day
16. If you pack your school lunch, how often do you pack a fruit?  
☐ Never    ☐ 1-2 days/wk    ☐ 3-4 days/wk    ☐ Every day
17. If you pack your lunch, how often do you pack a vegetable?  
☐ Never    ☐ 1-2 days/wk    ☐ 3-4 days/wk    ☐ Every day

**Circle The Answer You Think Is Correct**

1. True      False      Fruits are only available **fresh** during the time of the year they are “in season.”
2. True      False      Fruit is a good source of many vitamins and fiber.
3. True      False      Most vegetables are low in calories.
4. True      False      Vegetables cooked in a microwave oven are *less nutritious* than vegetables cooked in water on the stove.

**Put An “X” In The Answer You Think Is Correct**

5. Which of these fruits is a good source of vitamin A?
  - ☐ apples
  - ☐ cherries
  - ☐ peaches
  - ☐ pears
6. Based on a 2000 calorie diet, how many cups of fruits and vegetable **combined** do you think you need to eat every day?
  - ☐ 2 cups
  - ☐ 4 ½ cups
  - ☐ 5 cups
  - ☐ 6 ½ cups
7. Vegetable skin and pulp provide \_\_\_\_\_ to aid in digestion and help keep you ‘regular’.
  - ☐ Vitamins
  - ☐ Minerals
  - ☐ Nutrients
  - ☐ Fiber
8. Some nutrients in vegetables are \_\_\_\_\_ - \_\_\_\_\_ and will dissolve in the cooking liquid.
  - ☐ Heat-soluble
  - ☐ Water-soluble
  - ☐ Heat-sensitive
  - ☐ Fat-soluble
9. \_\_\_\_\_ are an excellent source of vitamin C.
  - ☐ Potatoes
  - ☐ Green beans
  - ☐ Oranges
  - ☐ Watermelons
10. About how many grams of fiber are recommended every day?
  - ☐ 15-25 grams
  - ☐ 20-35 grams
  - ☐ 10-20 grams
  - ☐ 30-45 grams



### How Do You Feel About Eating These Fruits And Vegetables?

	Like a Lot	It's OK	Don't Like	Hate It!	Never Tried
Pear	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kiwi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pineapple	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peach	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tangerine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Like a Lot	It's OK	Don't Like	Hate It!	Never Tried
Broccoli	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cauliflower	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Zucchini	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
French Fries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sweet Red Pepper	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Usual Fruit and Vegetable Intake

How often do you eat or drink each of the following foods? For example, if you drink fruit juice twice a week, write "2" before "per week." Include all foods you eat or drink, both at home and away from home.

1. How often do you drink fruit juices such as orange, grapefruit, or tomato?

☐ Per day  
☐ Per week  
☐ Per month  
☐ I never drink fruit juice

2. Not counting juice, how often do you eat fruit?

☐ Per day  
☐ Per week  
☐ Per month  
☐ I never eat fruit

3. How often do you eat green salad?

☐ Per day  
☐ Per week  
☐ Per month  
☐ I never eat green salad

4. How often do you eat potatoes not including French fries, fried potatoes, or potato chips?

☐ Per day  
☐ Per week  
☐ Per month  
☐ I never eat potatoes that aren't fried

5. How often do you eat carrots?

☐ Per day  
☐ Per week  
☐ Per month  
☐ I never eat carrots

6. Not counting carrots, potatoes, or salad, how many servings of vegetables do you usually eat? (Example: A serving of vegetables at both lunch and dinner would be two servings per day.)

☐ Per day  
☐ Per week  
☐ Per month  
☐ I never eat other vegetables



## APPENDIX C

### Lesson Plans

C-1	Lesson 1, Day 1
C-2	Lesson 2, Day 2
C-3	Lesson 3, Day 3
C-4	Lesson 4, Day 4
C-5	Lesson 5, Day 5



## C-1: Lesson 1

Topic: Food Guide Pyramid and Serving Sizes  
Grade Level: 9-12<sup>th</sup> grade

### Fruits and Vegetables in the Food Guide Pyramid: Servings and Serving Sizes. Lesson 1

#### FACS National Standard #4: Nutrition, Food and Wellness

**Key Concept:** Navigate mypyramid.gov website to learn about fruits and vegetables, including how many servings are needed per day, and what is an appropriate serving size.

**Objective:** At the end of the lesson students will be able to:

- Navigate mypyramid.gov website
- Identify what each color of the pyramid stands for
- Identify servings sizes of fruits and vegetables
- Identify recommended amounts per day of fruits and vegetables
- Explain calorie content of fruits and vegetables.

#### Materials:

1. Pretest (attached)
2. Food Guide Pyramid computer lab handout (attached)
3. Food Group Guide (attached)
4. Smart Board
5. Food Guide Pyramid Pocket Chart
6. Food models
7. Small basket

#### Procedure:

1. Pass out pretest to students and go over instructions with students.
2. Collect pretest after students have finished.
3. Ask students if they can name the 5 groups of the food guide pyramid.
4. Distribute Food Group Guide handout.
5. Discuss the five groups of the food guide pyramid.
  - Milk
  - Fruits
  - Grains
  - Vegetables
  - Meat and Beans
6. Demonstrate the different types of foods in each group by displaying food models.
7. Have students turn handout over to show how many cups of each food group they need per day based on a 2000 calorie diet.
8. Demonstrate serving sizes of each group, emphasizing how many cups of fruits and vegetables they should consume.
9. Explain that fruits and vegetables are good snack and food choices because they are low in calories and contain fiber which will keep them fuller longer.

10. Have a volunteer come up and show what 2 cups of fruit looks like using the food models.
11. Have another volunteer come up and show what 2 ½ cups of vegetables look like using the food models.
12. Hold up food models of fruits and vegetables to display correct amounts students should have based on a 2000 calorie diet.
13. Pass around food models to students so they can visualize a serving size.
14. Set up Smart Board to display [www.myramid.gov](http://www.myramid.gov).
15. Pass out Food Guide Pyramid computer lab handout.
16. Do steps 1-5 on the Food Guide Pyramid computer lab handout.
17. Have students watch animation on the Smart Board.
18. Go over directions on the handout with the students and assign the handout as homework.
19. Set up Food Guide Pyramid Pocket Chart.
20. Place the pictures of food from the Food Guide Pyramid Pocket Chart in the small basket
21. Have a student volunteer come up and draw a card from the basket and place the card drawn in the correct pocket on the Food Guide Pyramid Pocket Chart.
22. As the students draw the cards have them say what the food is, what group it goes in, and how many cups a person should have per day based on a 2000 calorie diet.
  - Milk- 3 cups
  - Fruits- 2 cups
  - Grains- 6 oz
  - Vegetables- 2 ½ cups
  - Meat and beans- 5 ½ oz
23. Continue until all cards have been drawn and placed into the correct pockets.

**Activities:**

1. Give pretest.
2. Pass out Food Group Guide handout and go over in class with students.
3. Show students food models.
4. Have students display with the food models the correct amount of fruits and vegetables to have per day based on a 2000 calorie diet.
5. View animation on Smart Board.
6. Have the students complete Food Guide Pyramid Computer Lab handout as homework.
7. Use Food Guide Pyramid Pocket Chart to show different foods, where they belong in to Food Guide Pyramid, and how many cups to have per day.
- 8.

**Summary:**

- We have gone over the different groups of the Food Guide Pyramid.
- I have shown you different serving sizes of fruits and vegetables and discussed the recommended amounts to have in the diet each day. For fruits a person on a 2000 calorie diet needs 2 cups. For vegetables a person on a 2000 calorie diet needs 2 ½ cups

- I have shown you the [www.mypyramid.gov](http://www.mypyramid.gov) animation so you know how many servings of fruits and vegetables to eat each day depending on your height and weight.
- You have a computer assignment to familiarize yourself with fruits and vegetables, the serving sizes, and how to incorporate them into your diet.
- You have also been able to play around with the Food Guide Pyramid and should know where certain food fit into the Food Guide Pyramid.

**References:**

- [www.mypyramid.gov](http://www.mypyramid.gov)
- Food Group Guide handout from Washington State Dairy Council
- Food Guide Pyramid Pocket Chart from [www.enasco.com](http://www.enasco.com)
- Food Guide Pyramid Computer Lab handout

NAME \_\_\_\_\_ PER. \_\_\_\_\_

### MY PYRAMID COMPUTER LAB DIRECTIONS

1. Get on the internet. Log on to [www.mypyramid.gov](http://www.mypyramid.gov)
2. On the home page, notice the picture of the pyramid labeled "Steps to a Healthier You". Scroll down to "Spotlights".
3. Click on "Animation," under multimedia.
4. Choose English or Spanish / PC or Mac User.
5. Listen to and watch the animation.

The food groups are color-coded.

Orange is for \_\_\_\_\_.

Green is for \_\_\_\_\_.

Red is for \_\_\_\_\_.

Blue is for \_\_\_\_\_.

Purple is for \_\_\_\_\_.

Yellow is for \_\_\_\_\_.

Why are some colored bands wider than the others?

The steps remind us to \_\_\_\_\_ everyday.

How many different pyramids are there? \_\_\_\_\_

The pyramid that is just right for you depends on how many \_\_\_\_\_

you need and how \_\_\_\_\_ you are.

6. View the animation over again if needed in order to answer the above questions.
7. Go back to the home page. Look to the right and find "My Pyramid Plan".
8. Enter your age \_\_\_\_ (write it here too.)

Select your sex: circle male / female

Select your physical activity: circle 1.) Less than 30 minutes 2.) 30 to 60 minutes  
3.) More than 60 minutes

Click "submit".

9. Now the computer has selected, out of the 12 pyramid plans, the one that is correct for you. Look above the colored chart and fill in the blank in this statement:

"Your results are based on a \_\_\_\_\_ calorie pattern."

How much food from each food group does the chart say you should have each day?

Grains \_\_\_\_\_ oz.

Vegetables \_\_\_\_\_ cups

Fruits \_\_\_\_\_ cups

Milk \_\_\_\_\_ cups

Meat & Beans \_\_\_\_\_ oz.

10. Go back to the Home Page. Scroll down. Select "Inside the Pyramid".

11. Go back and click on the green band. Fill in the following spaces.

Vegetables: \_\_\_\_\_ your veggies.

Click on "Learn More". Scroll down.

List 3 of your favorite foods from the vegetable group.

\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

12. Click on View Vegetable Food Gallery.

What is the serving size of...?

Broccoli: \_\_\_\_\_

Baby carrots: \_\_\_\_\_

Baked potato: \_\_\_\_\_

Cooked corn: \_\_\_\_\_

Green beans: \_\_\_\_\_

13. Click on Tips to Help you Eat More Vegetables.

14. List 3 ways to include more vegetables in the diet.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

15. Go back and click on the red band. Fill in the following spaces.

Fruits: \_\_\_\_\_ on fruits.

Click on "Learn More". Scroll down.

List 3 of your favorite foods from the fruit group.

\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

16. Click on View Fruits Food Gallery.

What is the serving size of...?

Fruit cocktail: \_\_\_\_\_

Orange juice: \_\_\_\_\_

Raisins: \_\_\_\_\_

Strawberries: \_\_\_\_\_

Bananas: \_\_\_\_\_

17. Click on Tips to Help you Eat More Fruits.

18. List 3 ways to include more fruits in the diet.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

# FOOD GROUP GUIDE

Enjoy a wide variety of nutrient-rich foods from each food group every day.



Milk



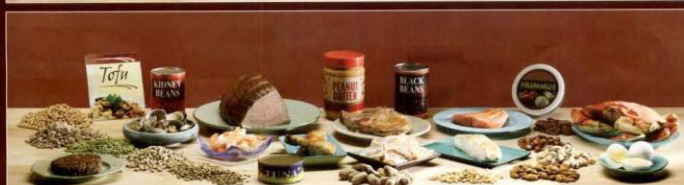
Fruits



Grains



Vegetables



Meat & Beans

## FOOD GROUP GUIDE

### Amounts Count!

For a 2000 calorie diet, you need the amounts below from each food group every day. To find the amounts that are right for you go to [www.MyPyramid.gov](http://www.MyPyramid.gov).

### Make your choices from each food group count.

Because no one food has all the nutrients you need for good health, it is important to enjoy a wide variety. Eating the amount of foods that your body needs and being active will help you to have:

- Better overall health and energy
- Lower risk of heart disease, diabetes, and certain types of cancer
- Stronger bones and muscles
- A healthy body weight

#### Milk

For calcium, potassium, and vitamin D

3 cups



Milk  
8 fluid oz (counts as 1 cup)



Cheese  
1 1/2 oz (counts as 1 cup)



Cheese  
1/2 cup shredded (counts as 1 cup)



Yogurt  
8 fluid oz (counts as 1 cup)



Frozen Yogurt, Pudding  
1/2 cup

#### Fruits

For potassium, dietary fiber, vitamin C, and folate

2 cups



100% Fruit Juice  
1/2 cup



Apple  
1 small (counts as 1 cup)



Raisins, Dried Fruit  
1/2 cup (counts as 1/2 cup)



Strawberries  
1/2 cup raw



Canned or Cooked Fruit  
1/2 cup

#### Grains

For dietary fiber, 8 vitamins, iron, magnesium, and selenium

6 oz



Bread  
1 slice (counts as 1 oz)



Cooked Rice, Pasta, Grits, Grain  
1/2 cup (counts as 1 oz)



Cereal Flakes  
1 cup (counts as 1 oz)



Tortilla, 1/2 English Muffin,  
1/2 Hamburger Bun (counts as 1 oz)



Popcorn  
3 cups (counts as 1 oz)

#### Vegetables

For potassium, dietary fiber, folate, vitamin A, vitamin E, and vitamin C

2 1/2 cups



Spinach, Raw Leafy Greens  
1 cup (counts as 1/2 cup)



Carrots  
1 cup



Baked Potato  
1 medium (counts as 1 cup)



Broccoli, Cooked Vegetable  
1/2 cup



Tomatoes, Raw Vegetable  
1/2 cup

#### Meat & Beans

For protein, 8 vitamins, vitamin E, iron, zinc, and magnesium

5 1/2 oz



Cooked Lean Meat  
3 oz



Cooked Fish, Poultry  
3 oz



Cooked Dry Beans or Peas  
1/2 cup (counts as 2 oz)



Lean Deli Meat  
2 sandwich slices (counts as 2 oz)



Nuts  
1 oz (counts as 2 oz)

#### Oils

For vitamin E and essential fatty acids



For good health, everyone needs a small amount of oils. Choose polyunsaturated or monounsaturated fats found in fish, nuts, avocados, and vegetable oils.

#### Amounts Count in Physical Activity, Too!

- Be physically active for at least 30 minutes most days of the week.
- You don't need to do it all at once. Getting 10 or more minutes of activity several times during the day can count up to the amount you need.

#### I will make these small changes for healthier eating:

- 1.
- 2.
- 3.



## C-2: Lesson 2

Topic: Benefits of Vitamins and Minerals in Fruits and Vegetables

Grade level: 9-12<sup>th</sup> grade

### Benefits of Vitamins, Minerals, and Fiber in Fruits and Vegetables Lesson 2

**Key Concept:** Be able to describe benefits of vitamins, minerals, and fiber in fruits and vegetables.

**Objective:** At the end of the lesson, students will be able to:

- Describe why vitamins and minerals are needed
- List various vitamins and mineral fruits and vegetables provide
- List what fruits and vegetables have certain vitamins and minerals
- Explain how many servings of fruits and vegetables are needed daily
- Describe benefits of fiber and how much a person should have in one day
- Explain cooking methods of fruits and vegetables

**Materials:**

- 1 medium sized basket
- Food models
- Measuring cups
- Wok
- 4 green peppers, cut into thin strips
- 4 red peppers, cut into thin strips
- 3 bags of sugar snap peas
- 1 large onions, chopped
- 2 teaspoons olive oil
- Garlic
- 3 summer squash, cut into thin strips
- Chalk and chalkboard
- Felt board
- Pictures of food from Food Guide Pyramid Pocket Chart
- Velcro
- 1 index card with calcium written on it
- 1 index card with folic acid written on it
- 1 index card with potassium and magnesium written on it
- 1 index card with vitamin K written on it
- 1 index card with vitamin A written on it
- 1 index card with vitamin C written on it
- 25 small plates
- 25 forks

**Procedure:**

1. Ask students if they remember how many cups of fruits and vegetables they should have per day based on a 2000 calorie diet. Review recommended amount of servings with students.
2. Review serving sizes with students by displaying food models.
3. Pick up the basket of food models. Ask students if they remember any vitamins or minerals that the fruits and vegetables contain.
4. Write list of vitamins and minerals on the chalkboard; put a \* next to vitamin A, vitamin C, vitamin K, folic acid, calcium, and potassium and magnesium.
5. Ask the students if they can name any benefits of each vitamin and/or mineral.
6. Explain to students that vitamin A is for healthy eyes, lungs, and skin and helps to resist infection; it can be found in dark green and deep yellow vegetables.
  - a. Give examples of good sources of vitamin A: apricots, cabbage, cantaloupe, carrots, grapefruit, lettuce, mangoes, spinach, sweet potatoes, tomatoes, watermelons
7. Explain to students that vitamin C is a powerful antioxidant. In addition, it helps you have healthy gums, for healing cuts and burns, and it helps to resist infections; it can be found in fruits, especially citrus fruits, tomatoes, peppers, greens, and raw cabbage.
  - a. Give examples of good sources of vitamin C: bell peppers, blackberries, broccoli, cabbage, cantaloupe, cauliflower, grapefruit, kiwi, lemons, limes, onions, oranges, pineapples, potatoes, radishes, raspberries, spinach, summer squash, strawberries, and tangerines
8. Explain to students that vitamin K is needed for normal blood clotting; it can be found in spinach, broccoli, turnip greens, kale, cabbage, and lettuce.
9. Explain that folic acid is needed for healthy red blood cells, a healthy heart, and helps prevent birth defects such as a brain or spinal cord defect; it can be found in green leafy vegetables, legumes, asparagus, and broccoli.
  - a. Give examples of foods high in folic acid: asparagus, broccoli, chickpeas, lentils, lima beans, pinto beans, spinach, strawberries, white beans
10. Explain that calcium is for strong bones and blood pressure control; it can be found in turnip and mustard greens, collards, kale, and broccoli.
11. Explain that potassium and magnesium work together to help control blood pressure and make the heart beat; it can be found in fruits, especially orange juice, bananas, dried fruits, and potatoes.
  - a. Give examples of foods high in potassium and magnesium: lima beans, bananas, broccoli, chickpeas, kiwi, potatoes, tomatoes, spinach
12. Set up felt board. And place the cards with the vitamin/mineral on the left hand side of the board, going down the board.
13. Students are going to come up and draw a card from the Food Guide Pyramid Pocket Chart and place it next to the vitamin/mineral that it contains.
14. Have a volunteer come up and draw a card and state the name of the fruit or vegetable.
15. Have the student put the picture of the fruit or vegetable next to the vitamin/mineral it contains.
16. Finish until felt board is full and no more cards/pictures can fit.

17. Ask students if they know why fiber is so important and in what types of food they can find fiber.
18. Explain that there are two types of fiber- soluble and insoluble.
  - a. Soluble fiber slows digestion and can be found in oat bran, barley, nuts, seeds, beans, lentils, peas, and some fruits and vegetables.
  - b. Insoluble fiber helps food pass more quickly through the stomach and intestines and can be found in wheat bran, vegetables, and whole grains.
19. Explain to students that diets high in fiber help lower cholesterol, aids in digestion, and can help reduce the risk of some cancers.
20. Explain that the getting 20-35 grams of fiber per day is recommended.
21. Pull out the wok and tell students you are going to demonstrate how to make a simple stir fry.
22. Tell them you are adding olive oil and garlic, then putting in the vegetables.
23. As the vegetables are sautéing, explain to students that a stir fry is a good meal because the vegetable are low in calories and high in fiber.
24. Explain different cooking methods of vegetables and how they affect the vitamins/minerals and fiber (no impact) in the vegetable.
  - a. Microwaving vegetables is a good way to retain the vitamins/minerals
  - b. Steaming is another good way to retain vitamins/mineral in vegetables
  - c. Explain that the standard boiling method often overcooks vegetables and therefore they lose intact fibers and nutrients.
  - d. The ideal way to cook vegetables is to steam them in the microwave or on top of the stove.
25. Explain that some nutrients in fruits and vegetables are water-soluble and can dissolve in the cooking liquid.
26. Tell them there will be 3 grams of fiber in ½ cup.
27. Divide the stir fry on the small plates evenly among the students to eat and enjoy.

**Activities:**

1. Discussion with students
2. Felt board activity
3. Make stir fry

**Summary:**

- Summarize the importance of vitamin A, C, and K, folic acid, calcium, potassium and magnesium in the diet (review with students).
- Summarize the vitamins and minerals contained in different fruits and vegetables
- Summarize the importance of fiber and the recommended amounts of fiber per day. Quiz students about the 2 different types of fiber and how many grams of fiber are recommended per day.
- Review the recommended number of cups of fruits/day
- Review the recommended number of cups of vegetables/day

**References:**

- Food Guide Pyramid Pocket Chart
- [www.fruitsandveggiesmorematter.org](http://www.fruitsandveggiesmorematter.org)

## C-3: Lesson 3

Topic: Benefits of Fruits and Vegetables

Grade level: 9-12<sup>th</sup> grade

### Benefits of Eating a Variety of Colorful Fruits and Vegetables

#### Lesson 3

**Key Concept:** Describe the benefits of eating a variety of colorful fruits and vegetables.

**Objective:** At the end of the lesson, students will be able to:

- Identify various fruit and vegetables in color categories
- Identify why different colors of fruits and vegetables are beneficial
- Describe what benefits each color of fruits and vegetables provide
- Explain how many servings of fruits and vegetables are needed daily
- Identify what an appropriate serving size would be

**Materials:**

- *What Color is your Food?* handout (attached)
- Food models
- Pictures of exotic fruits
- 2 medium sized baskets
- Measuring cups
- Chalkboard and chalk
- 1 5in x 2in piece of blue/purple construction paper
- 1 5in x 2in piece of green construction paper
- 1 5in x 2in piece of white construction paper
- 1 5in x 2in piece of yellow/orange construction paper
- 1 5in x 2in piece of red construction paper
- Sheet of paper for each student to write on
- 2 zucchini, cut into thin strips
- Asparagus, cut into bit size pieces
- Celery, cut up
- 2 heads of cauliflower, cut up
- Mushrooms, cut up
- Ranch dip
- 25 small plates
- 1 spoon for dip

**Procedure:**

1. Prior to class beginning cut up pieces of the colored construction paper and place in the basket that does not have the fruits and vegetables in it.
2. Prior to class beginning make up a vegetable tray to provide 25 servings.
3. Give students the pretest to assess their knowledge, attitude of and behavior toward fruits and vegetables.
4. Pass out the *What Color is your Food?* handout.

5. When class starts, display a basket of fruit and vegetables in the front of the classroom. Hold up food models of fruits and vegetables and have students identify the fruit or vegetable.
6. Grab the basket with the construction paper in it and have a volunteer student draw a piece of paper from the basket; hold up the piece of paper.
7. Ask volunteers to name a fruit or vegetable that is the color of the construction paper that was drawn. Write their answer on the chalkboard.
8. Ask the students if they can think of other fruits and vegetables that are the same color as the paper. Write those on the chalkboard.
9. Have another volunteer student draw another color from the basket.
10. Hold up the piece of paper and have another volunteer name a fruit or vegetable that is the same color as the construction paper. Write that fruit or vegetable on the chalkboard.
11. Ask the students to volunteer if they know any other fruits or vegetables that go along with that same color. Write those fruits or vegetables on the chalkboard.
12. Continue drawing the construction paper out of the basket until all the colors have been drawn. Continue writing the fruits and vegetables that were said on the chalkboard.
13. Once all the colors are on the board ask the students if any of them know what benefits come with those colors.
14. Explain to students that your blues/purples contain phytochemicals and antioxidants that help reduce your risk of some cancers, keep your urinary tract healthy, help with memory, and help with healthy aging.
15. Explain that your green fruits and vegetables contain antioxidants that can also help reduce risk of cancer, protect eyes, and help keep bones and teeth strong.
16. Explain that white fruits and vegetables can help them have a healthy heart and reduce the risk of some cancers.
17. Explain that yellow fruits and vegetables contain phytochemicals that help keep the immune system strong, protect the eyes, and aid in keeping a healthy heart.
18. Explain that including red fruits and vegetables in their diet can help with memory, keep urinary tract healthy, protect the heart, and reduce the risk of some cancers.
19. Describe to students the amount of a fruit or vegetables recommended per day based on a 2000 calorie diet. Hold up a small apple and explain that is one serving. Explain that a serving size of fruits such as apples, pears, oranges, and peaches are the size of a tennis ball.
20. Display what a  $\frac{1}{2}$  cup of berries looks like. Explain that  $\frac{1}{2}$  cup of fruit juice would count for  $\frac{1}{4}$  of the amount of fruits recommended per day; therefore they should eat an additional  $\frac{3}{4}$  cup of fruit to equal 2 cups.
21. Explain to students that a typical person needs at least 2 cups of fruit and 2  $\frac{1}{2}$  cups of vegetables per day.
22. Display what 2 cups of fruit looks like and 2  $\frac{1}{2}$  cups of vegetables look like.
23. Pass out a sheet of paper to each student. Ask them to write down their favorite fruit and vegetable.
24. Collect the papers and discuss the various ways the students prepare/eat their fruits and vegetables.

25. Have students turn to the last page (page 8) in their *What Color is your Food?* handout; have them write down at least 2 goals to help them incorporate more fruits and vegetables in their daily diet.
26. Bring out the vegetable tray and divide vegetables and dip evenly among students.
27. Eat and enjoy!

**Activities:**

1. Have students write down, on the paper, their favorite fruit and vegetables. Have them describe how they like to prepare/eat their fruits and vegetables.
2. Pass out *What Color is your Food?* handout and have students write down at least 2 goals.
3. Taste test vegetables.

**Summary:**

- It is important to “taste the rainbow”... but I don’t mean Skittles!
- I have shared with you what is an appropriate serving of a fruits and vegetables (ask leading questions to affirm they know)
- I have shared with you how many fruits and vegetables are needed daily (ask leading questions to affirm they know)
- We have identified different fruits and vegetables in various color categories.
- We have learned the benefits each color category provides the body.
- We have also learned what your peers’ favorite fruits and vegetables are and how they like to prepare them.

**Reference:**

- *What Color is your Food?* Handout from NDSU Extension Office

## C-4: Lesson 4

Topic: Incorporating vegetables into daily diet

Grade level: 9-12<sup>th</sup> grade

**Learn how to Incorporate More Vegetables into Daily Diet**

**Lesson 4**

**Key Concept:** Be able to identify ways to incorporate more vegetables into daily diet.

**Objective:** At the end of the lesson, students will be able to:

- Identify the amount of vegetables recommended per day
- Make vegetable pizza
- Make salsa

**Materials:**

- 4 kitchen labs
- Recipes for vegetable pizza (attached)
- Recipes for salsa (attached)
- 2 15 x 10 x 1-inch pans
- 20 small bowls
- 16 cutting knives
- 4 cans of refrigerated crescent dinner rolls
- 2 packages of cream cheese, softened
- 1 cup of sour cream
- 2 teaspoons of dried dill weed
- ¼ teaspoon of garlic powder
- 1 cup of small fresh broccoli florets
- 2/3 cup of quartered cucumber slices
- 2 plum (Roma) tomatoes, seeded and chopped
- 1/2 cup of shredded carrots
- 2 cloves of garlic
- 4 green onions
- 4 jalapeño peppers
- 2 28 oz cans chopped tomatoes
- 2 tablespoons lemon juice
- 12 sprigs of cilantro
- Salt
- Pepper
- 2 bag of tortilla chips
- Food models
- 2 food processors
- Handout on how to incorporate vegetables (attached)
- 2 shredders
- 16 medium sized plates
- 16 forks
- 4 spatulas

- 8 spoons
- Napkins/paper towels
- Dishwashing soap
- Dish towels
- 4 drying racks

**Procedure:**

1. Ask the students if they remember how many cups of vegetables they should eat per day based on a 2000 calorie diet.
2. Review with students the different ways of cooking vegetables
  - a. Microwave
  - b. Steaming using the stove or the microwave
  - c. Vegetables lose some nutrients and intact fiber by over cooking.
3. Review with students the vitamins and minerals found in vegetables.
4. Ask students how they incorporate vegetables in their diet.
5. Pass out handout of ways to incorporate vegetables in their daily diet.
6. Discuss handout with students.
7. Divide class into 4 different kitchen labs.
8. Pass out recipe for vegetable pizza to 2 kitchen labs.
9. Pass out recipe for salsa to 2 different kitchen labs.
10. Go over recipe with students and make sure they have everything needed for the recipe.
11. Instruct students that they will need to shred their own carrots, quarter their own cucumbers, chop their own tomatoes, and cut up their own broccoli for the vegetable pizza.
12. Have students making the vegetable pizza preheat oven to 375 degrees.
13. Instruct students that while the crust is baking one student should be mixing the cream cheese, sour cream, dill and garlic. The other students in the lab should be cutting up the vegetables.
14. Have students follow the vegetable pizza recipe.
15. Have the other kitchen follow the salsa recipe.
16. Have students divide pizza evenly among members of the lab.
17. Have students divide salsa evenly among members of the lab.
18. Eat and enjoy.
19. Before the bell rings have students clean up their area and put their dishes away.

**Activities:**

1. Make vegetable pizza
2. Pass out handout on how to incorporate vegetables into diet.
3. Make salsa

**Summary:**

- You have learned and reviewed the amount of cups of vegetables to have per day.
- You have learned different ideas of how to incorporate vegetables into your diet.



**References:**

- [www.pillsbury.com](http://www.pillsbury.com) for vegetable pizza recipe
- [www.mypyramid.gov](http://www.mypyramid.gov) for tips to add vegetable to diet
- [www.dltk-kids.com](http://www.dltk-kids.com) for salsa recipe



### Tips to Add Vegetables to Daily Diet

Eat sandwiches or wraps that include several vegetables, such as mushrooms, tomatoes, sprouts, green peppers, cucumbers, or other raw vegetables.

Include a mix salad or a vegetable soup with your lunch or dinner.

Choose a baked potato or sweet potato in place of French fries.

Add crunch and color to pasta or potato salad with green or red pepper strips, broccoli florets, carrot slices, or cucumber.

When grilling be sure to wrap vegetables in aluminum foil, or grill skewers of eggplant, zucchini, or cherry tomatoes.

Bring color or character to your salads by sprinkling in baby carrots, shredded cabbage, or spinach leaves.

At restaurants try vegetable pizza, vegetable pasta, or a fresh vegetable wrap. Instead of French fries, order a plain baked potato, vegetable soup, or a small salad.

Shred carrots or zucchini into meatloaf, casseroles, quick breads, and muffins.

Use cut up vegetables as part of afternoon snacks.



## Easy Salsa

### Ingredients:

- 1 clove garlic
- 2 green onions
- 1 to 3 jalapeno peppers (remove the seeds if you don't want it too hot)
- 28 oz can chopped tomatoes, drained (reserve 1 Tbsp of the juice)
- 1 Tbsp lemon juice (or squeeze 1/2 a fresh lemon)
- OPTIONAL: fresh cilantro leaves (depends on the flavor you like)
- salt and pepper

### Directions:

1. Put first 3 ingredients in a food processor and pulse (or if you don't have a food processor, mince them with a knife)
2. Add tomatoes, 1 Tbsp of the tomato juice, 1 Tbsp fresh lemon, cilantro leaves and salt and pepper to taste. Pulse LIGHTLY!
3. Again, if you don't have a food processor, just chop your tomatoes up a bit more than they come in a can and mix all the ingredients together in a bowl.
4. Put a little sprig of cilantro on top to decorate.
5. Serve cold with tortillas.



## Easy Veggie Pizza

### Ingredients:

- 2 cans (8 oz each) refrigerated crescent dinner rolls
- 1 package (8 oz) cream cheese, softened
- 1/2 cup sour cream
- 1 teaspoon dried dill weed
- 1/8 teaspoon garlic powder
- 1/2 cup small fresh broccoli florets
- 1/3 cup quartered cucumber slices
- 1 plum (Roma) tomato, seeded, chopped
- 1/4 cup shredded carrot



### Directions:

1. Heat oven to 375°F. Separate cans of dough into 4 long rectangles. In ungreased 15x10x1-inch pan, place dough; press in bottom and up sides to form crust.
2. Bake 13-17 minutes or until golden brown. Cool completely, about 30 minutes.
3. In small bowl, mix cream cheese, sour cream, dill and garlic powder until smooth. Spread over crust. Top with vegetables. Serve immediately, or cover and refrigerate 1-2 hours before serving. Cut into 16 squares; cut each square in half diagonally.

## Pineapple Smoothie

### Ingredients:

3 cups unsweetened pineapple juice  
2 cups 1% buttermilk  
4 cups of ice  
4 (8 oz) cans unsweetened crushed pineapple  
½ cup sugar



### Directions:

1. Combine all ingredients in a blender or food processor.
2. Cover and blend until smooth.
3. Pour into glasses; serve immediately.

\*Note: This smoothie will need to be made in 2 separate batches.

## Peach-Berry Smoothies

### Ingredients:

6 cups strawberry yogurt  
3 cups peaches or nectarines  
3 cups sliced fresh strawberries  
3 cups ice



### Directions:

1. In a blender or food processor, place all ingredients.
2. Cover; blend on high speed 30-60 seconds or until smooth.
3. Pour into glasses. Serve immediately.

\*Note: This smoothie will need to be made in 3 separate batches.

## C-5: Lesson 5

Topic: Incorporating fruits into daily diet

Grade Level: 9-12<sup>th</sup> grade

**Incorporate More Fruits into Daily Diet  
Lesson 5**

**Key Concept:** Identify ways to incorporate more fruits into daily diet.

**Objective:** At the end of the lesson, students will be able to:

- Identify the amount of cups of fruits recommended per day
- Make fruit smoothies
- Identify ways to add more fruits to the diet.

**Materials:**

- Post test (attached)
- 4 kitchen labs
- 4 blenders
- Recipes for smoothies (attached)
- 50 small Dixie cups
- 72 seedless grapes
- 1 gallon of milk
- 6 (6oz) containers of peach yogurt
- 1  $\frac{1}{4}$  c. sugar
- 4 tablespoons vanilla extract
- 16 cups of ice
- 12 bananas
- $\frac{3}{4}$  cup vanilla yogurt
- 1 quart strawberry yogurt
- 2 cups strawberry yogurt
- $\frac{1}{4}$  cup honey
- 3 cups peaches or nectarines
- 3 cups unsweetened pineapple juice
- 2 cups 1% buttermilk
- 4 (8 oz) cans unsweetened crushed pineapple
- 45 strawberries
- Tips to add Fruits to Daily Diet handout (attached)
- Chalkboard and chalk

**Procedure:**

1. Review with students the number of cups of fruits a person should have based on a 2000 calorie diet.
2. Review the nutrients found in fruits and why they are important.
  - They provide phytochemicals and antioxidants.
  - They reduce the risk of some cancers.
  - Provide fiber which aids in digestion and helps lower cholesterol.

3. Ask students how they incorporate fruits in their diet.
4. Write those on the chalkboard.
5. Pass out Tips to Add Fruits to Daily Diet handout.
6. Discuss handout with students.
7. Divide class evenly into four kitchen labs.
8. Pass out a different smoothie recipe to each group.
9. Have students follow recipe given.
10. Drink and enjoy.
11. Have students clean up their area and put their dishes away.
12. Instruct students to take a seat and pass out post test.
13. Have students turn in post test once complete.

**Activities:**

1. Make fruit smoothies
2. Review recommended number of cups of fruits to have per day based on a 2000 calorie diet
3. Review nutrients found in fruits.
4. Discuss how to incorporate more fruits in the daily diet.
5. Give post test.

**Summary:**

- We have reviewed the number of cups of fruits to have per day.
- We have reviewed nutrients found in fruits and why they are important.
  - i. What fruits contain Vitamin C? citrus fruits
  - ii. Why is fiber important in the diet? Aids in digestion and helps lower cholesterol
  - iii. Why are fruits important in the diet? They provide antioxidants and phytochemicals
- We have also discussed ways to incorporate more fruits into the diet.
- We have made fruits smoothies to show a way to add more fruits into the diet.

**References:**

- [www.mypyramid.gov](http://www.mypyramid.gov)
- [www.eatbetteramerica.com](http://www.eatbetteramerica.com)
- [allrecipes.com](http://allrecipes.com)



### Tips to Add Fruits to Daily Diet

Perk up deli salads like coleslaw, chicken, or tuna with apple chunks, pineapple, or raisins.

Grill fruit skewers over medium-hot coals for a fun-to-eat and flavorful BBQ treat.

Toss grapefruit and/or orange sections in a fresh crunchy salad of mixed greens.

At breakfast, top your cereal with bananas or peaches; add blueberries to pancakes; drink 100% orange or grapefruit juice. Try a fruit mixed with low-fat or fat-free yogurt.

At lunch, pack a tangerine, banana, or grapes to eat, or choose fruits from a salad bar. Individual containers of fruits like peaches or applesauce are easy and convenient.

Try meat dishes that incorporate fruit, such as chicken with apricots or mango chutney.

For a dessert have baked apples, pears, or a fruit salad.

Cut-up fruit makes a great snack. Either cut them yourself, or buy pre-cut packages or fruit pieces like pineapples or melons. Or, try whole fresh berries or grapes.

Dried fruits also make a great snack. They are easy to carry and store well. Because they are dried,  $\frac{1}{4}$  cup is equivalent to  $\frac{1}{2}$  cup of other fruits.

As a snack, spread peanut butter on apple slices or top frozen yogurt with berries or slices of kiwi fruit.

Frozen juice bars (100% juice) make healthy alternatives to high-fat snacks.



## Banana Berry Smoothie

### Ingredients:

12 cups of milk  
12 bananas  
36 strawberries  
 $\frac{3}{4}$  cup vanilla yogurt  
 $\frac{1}{4}$  cup honey



### Directions:

1. In a blender, combine milk, bananas, strawberries, yogurt and honey.
2. Blend until smooth. Pour into glasses and serve

\*Note: Will need to make this smoothie in a few separate batches.

## Starlit Summer Smoothie

### Ingredients:

72 seedless grapes  
3 cups milk  
6 (6 oz) containers peach yogurt  
 $\frac{3}{4}$  cup white sugar  
 $\frac{1}{4}$  cup vanilla extract  
6 cups of ice



### Directions:

1. In a blender, mix the grapes, milk, peach yogurt, sugar, vanilla, and ice.
2. Blend until smooth.

\*Note: This smoothie will need to be made in 3 separate batches.



## APPENDIX D

### Letter of Permission

APPENDIX D  
Letter of Permission



**Crothersville Junior Senior High School**

109 N. Preston St.  
Crothersville, IN 47229

Phone: 812-793-2051

Fax: 812-793-3004



*Principal: David Schill*

**"Home of the Tigers"**

*Dean Of Students: Drew Markel*

September 20<sup>th</sup>, 2010

To Whom It May Concern,

I, Mr. David Schill, grant permission for Monica Durham to conduct a research study assessing the nutrition knowledge, attitudes, and consumption patterns of fruits and vegetables among high school students. The study will involve high school students at Crothersville Community School that are enrolled in Mrs. Kaye Durham's Nutrition Wellness class and Adult Roles class. Mrs. Durham's daughter, Monica, will be conducting the research and gathering and analyzing the data.

If you were to have any questions or concerns, please contact me at (812) 793-2051 or at Crothersville High School, 109 North Preston St., Crothersville, IN 47229.

Sincerely,

David Schill

Crothersville Jr/Sr High School Principal

## APPENDIX E

### Letter of Information

## APPENDIX E

### Letter of Information

January 2011

Dear Parents:

Did you know that fewer than one in five high school students eat the recommended number of five servings of fruits and vegetables each day?

My name is Monica Durham. I am completing my Masters of Science degree in Dietetics at Ball State University. In an effort to increase fruit and vegetable consumption among high school students, I have developed a series of five “hands-on” nutrition education lesson plans that focus on the health benefits of fruits and vegetables for my thesis project. These lessons have been reviewed by my thesis committee, including the Family and Consumer Sciences Teacher Educator at Ball State University, for their accuracy and their potential impact on high school students. Four of the five lessons include either a food demonstration or a lab where your son or daughter will be making a variety of fun foods using various fruits and vegetables. My mother, Mrs. Durham, will be teaching these five lessons to the students in her Nutrition and Wellness class this semester.

To measure the impact of these lessons, Mrs. Durham will be giving a brief pretest to the students in both the Nutrition and Wellness class and in the Adult Roles class. Then, she will teach the lessons in the Nutrition and Wellness class. Upon completion of the five lessons, she will once again give a posttest to both classes to determine if the students who were exposed to the lessons increased their knowledge of, attitude toward, and consumption of fruits and vegetables. After matching the pre-tests and post-tests, Mrs. Durham will remove the sheet with your son or daughter's name, so when I receive the results, they will be completely anonymous.

Mrs. Durham has received permission from the principal to let me use the data from the pre and post-tests for my thesis. This letter is to inform you about this study. The lessons being taught will coincide with what is normally taught in the classroom, but with more depth and additional laboratory experience. If for some reason you do not want your child to participate in the testing, please let Mrs. Durham know and she will provide them with an alternate assignment that they can complete in the principal's office. There are no foreseeable risks to your child. Your child's participation is completely voluntary. There is no penalty for not participating. All data collected will be confidential; only group data will be reported in the thesis; all person-identifiable data will be coded with a random alpha-numeric code so that your child cannot be identified by the researcher.

If you would like to talk to Mrs. Durham about this study, please contact her at the school. If you would like to talk to me about my thesis, you can reach me at (812) 358-4972 or at [mrddurham@ballstate.bsu.edu](mailto:mrddurham@ballstate.bsu.edu) for questions or concerns. You may also contact my major professor, Dr. Carol Friesen, at (317) 326-2994. For questions about your rights as a research subject, please contact the Director, Office of Research Compliance, Ball State University, Muncie, IN 47306, (765) 285-5070 or at [irb@bsu.edu](mailto:irb@bsu.edu).

Sincerely,

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